

**DARPA-BAA-09-40 Deep Learning (DL)
Broad Agency Announcement (BAA)**

for

**Information Processing Techniques Office (IPTO)
Defense Advanced Research Projects Agency
(DARPA)**

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Part One: Overview Information

- **Federal Agency Name** – Defense Advanced Research Projects Agency (DARPA), Information Processing Techniques Office (IPTO)
- **Funding Opportunity Title** – Deep Learning (DL)
- **Announcement Type** – Initial Broad Agency Announcement (BAA)
- **Funding Opportunity Number** – DARPA-BAA-09-40
- **Catalog of Federal Domestic Assistance Numbers (CFDA)** – 12.910 Research and Technology Development
- **Key Dates**
 - Posting Date – see www.fbo.gov
 - Proposal Due Date
 - **Initial Closing – 12:00 noon (ET), 18 June 2009**
 - **Final Closing – 12:00 noon (ET), 14 April 2010**
 - **An Industry Day will be held on 7 May 2009 in Arlington, Virginia. See Section VIII.B for details.**
 - **Interested parties must be registered by 28 April 2009.**
- **Anticipated individual awards** – Multiple awards are anticipated for the Deep Learning Development Teams and a single award for the Evaluation Team.
- **Types of instruments that may be awarded** – Procurement contract, cooperative agreement or other transactions.
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Part Two: Full Text of Announcement

I. FUNDING OPPORTUNITY DESCRIPTION

INTRODUCTION

The Defense Advanced Research Projects Agency (DARPA) often selects its research efforts through the Broad Agency Announcement (BAA) process. The BAA will appear first on the FedBizOpps website, <http://www.fedbizopps.gov/>, and Grants.gov website at <http://www.grants.gov/>. The following information is for those wishing to respond to the BAA.

DARPA is soliciting innovative research proposals in the area of deeply layered machine learning or, simply, Deep Learning (DL). Over the course of the envisioned program, performer teams will build a universal machine learning engine that uses a single set of methods in multiple layers (at least three internally) to generate progressively more sophisticated representations of patterns, invariants, and correlations from data inputs. The engine is expected to be applicable to multiple input modalities given only changes to the inputs' preprocessing, and is expected to be able to learn important characteristics of the inputs and produce useful representations solely on the basis of unlabeled inputs. Accomplishing many of the tasks set by the program will require that the engine be able to produce and utilize sophisticated spatio-temporal representations.

In the second phase of the envisioned program, the engine is expected, given the addition of control and memory modules and a limited number of labeled inputs, to provide the basis for performing multiple tasks across different application areas. In the final phase of the envisioned program, the engine is expected to demonstrate significantly enhanced capabilities in producing representations and performing tasks given multi-modal inputs representing different aspects of the same external objects and events.

Proposed research should investigate innovative approaches that enable revolutionary advances in the internal representations of machine learning systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

BACKGROUND

A rapidly increasing volume of intelligence, surveillance, and reconnaissance (ISR) information is available to the Department of Defense (DOD) as a result of the increasing numbers, sophistication, and resolution of ISR resources and capabilities. The amount of video data produced annually by Unmanned Aerial Vehicles (UAVs) alone is in the petabyte range, and growing rapidly.

Full exploitation of this information is a major challenge. Human observation and analysis of ISR assets is essential, but the training of humans is both expensive and time-consuming. Human performance also varies due to individuals' capabilities and training, fatigue, boredom, and human attentional capacity.

One response to this situation is to employ machines that can simulate human capabilities for rapidly analyzing sensory input and identifying salient or anomalous features and events. A number of efforts with this objective are already underway within the DOD. Many of these efforts depend upon some form of learning machine that uses techniques developed over the last half-century. Examples of such machines are Support Vector Machines (SVMs), two-layer Neural Networks (NNs), and Hidden Markov Models (HMMs).

A characteristic common to all of these machines is that they employ a "shallow" architecture often consisting of an input layer, a layer that transforms the raw input features into a task-specific feature space whose states may be hidden from interaction with the environment, and an output layer. For example, an SVM is a specific case of a pattern analysis engine, or "kernel machine", whose first task-specific layer transforms the raw input into a feature space where learning using a linear separator is efficient. Similarly, two-layer neural nets are sufficient to represent any input-output function that can be learned by back-propagation. Additional layers do not increase intrinsic computational capability; in fact, learning can converge much more slowly because of noisy and weak error signals as more layers are added. HMMs are generally learned in a single flat layer although work on hierarchical HMMs has been considered. In general, shallow machines require expert task-specific human knowledge and adjustments, extensive supervised training on labeled data, and incur large computational costs

If one considers machine vision, shallow methods may be effective in creating simple internal representations such as oriented edges. A classification task such as recognizing a horse in an image will use these simple representations in many different configurations to recognize horses in various poses, orientations and sizes. Such a task requires large amounts of labeled images of horses and non-horses. This means that if the task were to change to recognizing cows, one would have to start nearly from scratch with a new, large set of labeled data. Deeply layered methods should create richer representations that may include furry, four-legged mammals at higher levels, resulting in a head start for learning cows and thereby requiring much less labeled data when compared to a shallow method. A Deep Learning system exposed to unlabeled natural images will automatically create high-level concepts of four-legged mammals on its own, even without labels. This is a bottom-up approach to learning which assumes that before you have a label, you must have a *concept* to label. The Deep Learning program assumes the ability to learn from unlabeled data in the first phase of the envisioned program.

PROGRAM OVERVIEW

The goal of the envisioned Deep Learning program is to discover and instantiate in a learning machine (Deep Learning System) a single set of methods that, when applied

repeatedly across multiple layers of the machine, yield more useful representations of audio/visual, sensor, and language information, using less labeled data more efficiently than any existing technologies.

The internal representations formed at any layer by a Core Deep Learner (as illustrated in Figure 2) are expected to be composed of simpler representations, concepts and invariances discovered at lower (closer to the input) layers in a hierarchical structure. Figure 1 shows a possible conception of representations in an imagined deep, hierarchical learning machine. This notional concept should not be taken literally as a requirement. The vision is to create core technology to revolutionize machine learning by creating complex hierarchical representations learned from unlabeled data. It is expected that this type of learning machine will dramatically reduce the need for human intervention and hand data labeling, and improve knowledge transfer in key applications.

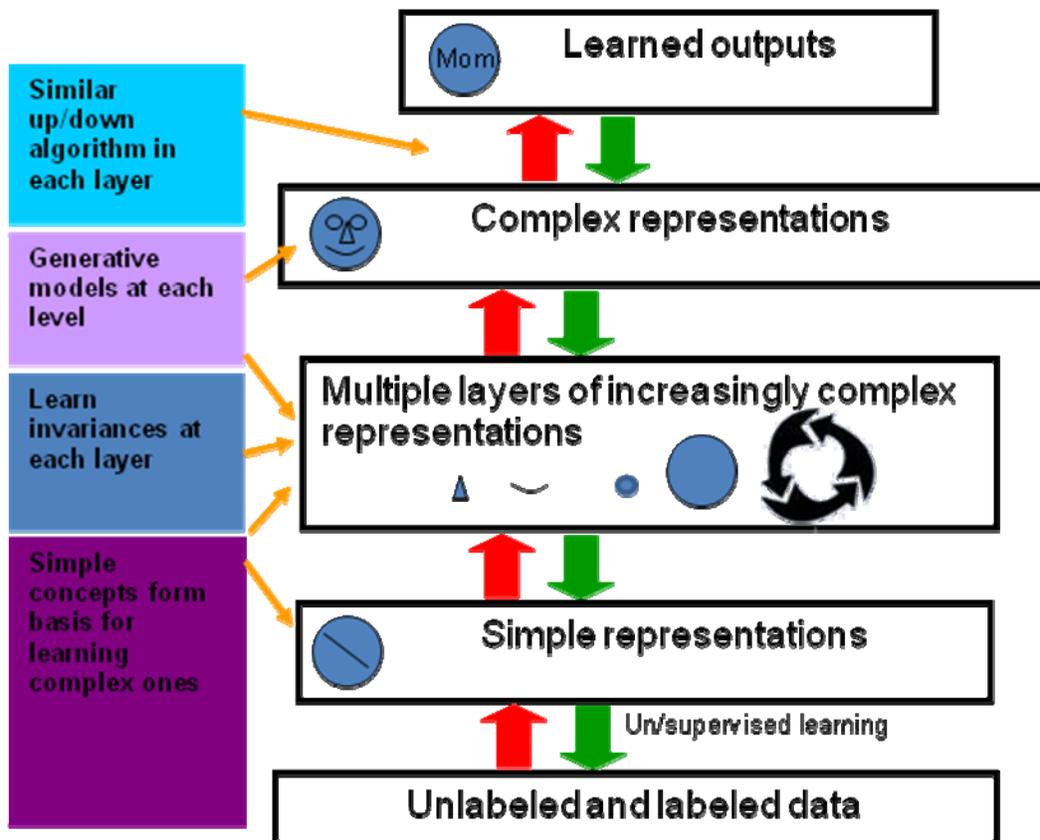


Figure 1 - Deep, Hierarchical, Multi-layered Learning

To achieve its goals, the Deep Learning program will be focused on:

- 1) Developing a Core Deep Learner that creates rich encodings of input data by using the same set of algorithms across multiple layers. Each layer may represent or encode the data from layers below (closer to the sensory inputs), and may also

provide feedback to other layers that can improve their computations. The machine should be best at learning given a few labeled examples and a huge number of unlabeled examples.

- 2) Demonstrating that the Core Deep Learner can be applied successfully, and with little or no modification, to processing input data from different modalities and application areas.
- 3) Demonstrating that the Core Deep Learner can produce useful representations of unlabeled input data, and more useful representations than current technologies using significantly less labeled data than those technologies.
- 4) Demonstrating that the outputs of the Core Deep Learner can be successfully interpreted and applied to the performance of multiple tasks.
- 5) Demonstrating that the Core Deep Learner's performance can be boosted by integrating the representations of input data from multiple modalities.

The Deep Learning program aims to revolutionize machine learning by creating a new class of learning machines that overcome the computational limitations of current "shallow" learning machines. This will be done by building machines that can use many layers of processing in a manner that is, at least superficially, similar to that used by biological brains.

In addition to the scientific research and application demonstrations, a further end objective of the Deep Learning program is to support increased growth and development of the broader machine-learning community by making publicly available many, if not all, Deep Learning software modules, algorithmic approaches, evaluation criteria and datasets in several application domains for use by researchers. DARPA's past experience is that such selected releases increase the available resources devoted to additional research in areas of interest to DARPA.

The conceptual architecture shown below in Figure 2 is a notional (should not be taken literally as a requirement) depiction of system modules that might be included in a fully functioning Deep Learning system.

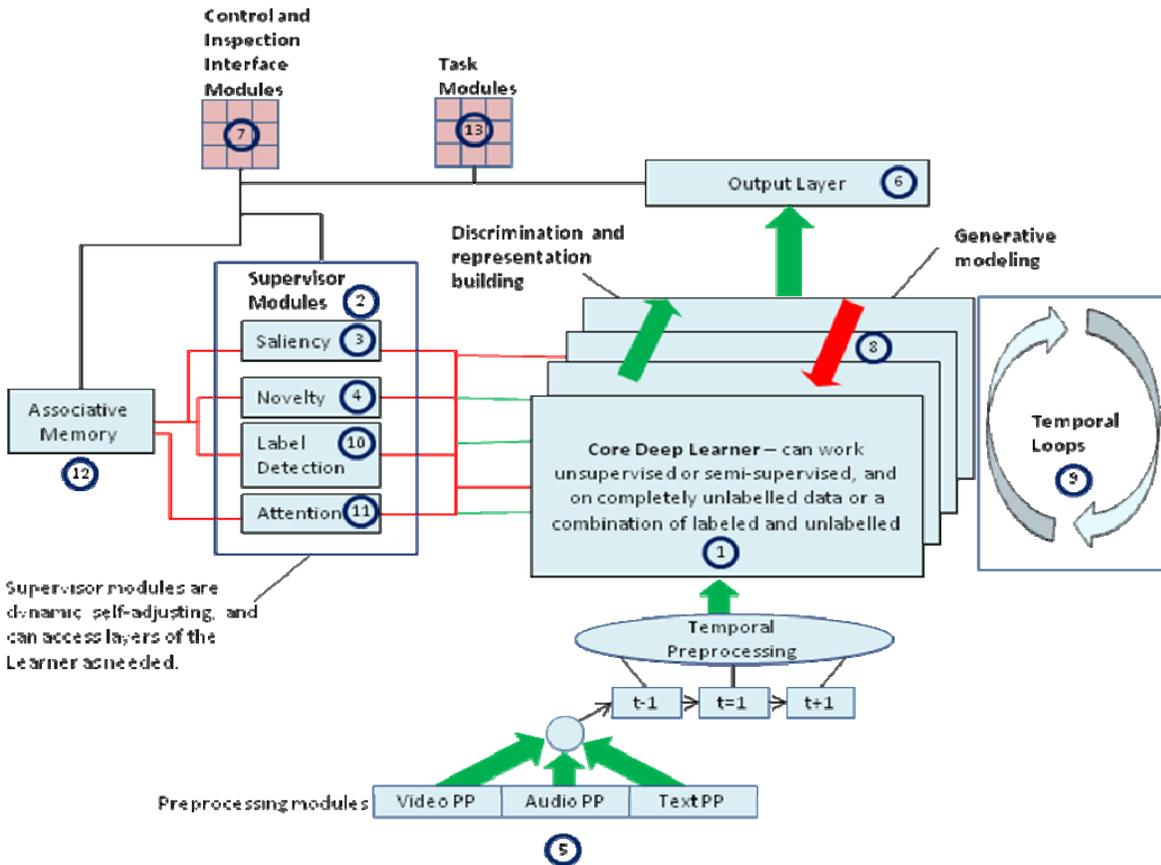


Figure 2 - Notional Deep Learning System Architecture

The key technology to be developed includes:

- A Core Deep Learner ((1) in Figure 2, above) that employs multiple layers using a single set of methods at each layer to create increasingly refined and useful representations of input data
- Methods or modules that supervise or coordinate learning within the machine without human intervention (2). These may take a variety of forms including:
 - Methods for setting learning rates and other parameters
 - Methods for using results of discrimination and classification
 - Recognition of features and events salient to a task (3)
 - Recognition of features and events that are anomalous within the experience of the learner (4), and the triggering of appropriate responses
- Preprocessing modules (5)
- An output classification and interface layer (6)
- Interfaces to allow meaningful examination of the system's processing and intermediate representations for the purpose of system tuning and evaluation (7)
- Additional features that may not be necessary in all approaches might include:
 - Generative modeling (8)
 - Spatio-temporal modeling using recurrent connections, both feed-forward and feedback, between some of the layers (9)

- Attentional mechanisms to recognize portions of inputs or portions of intermediate layer codes for which labels are known (10)
- Automated selection of particular knowledge modules, i.e. attentional control (11)
- Memory modules (12)
- Task modules (13)

A Deep Learning system will be capable of taking raw inputs and extracting from them useful features and representations that can be applied to a variety of tasks such as recognizing entities and classifying them, discerning relationships between entities, detecting anomalous entities, and representing sequences.

PROGRAM SCOPE

The envisioned Deep Learning program will be divided into three phases, each with multiple high-order tasks, as outlined below. These tasks fall into two separate technical areas: 1) Deep Learning System Development and 2), Deep Learning Evaluation. This BAA seeks proposals that address each phase of the multi-phase Deep Learning program. As stated above, proposed research should investigate innovative approaches and techniques that lead to or enable revolutionary advances in the state of the art. Proposals must address research that substantially contributes toward the goals stated and should be organized to fall within the tasks for each phase (described in detail below). Proposals shall provide detailed descriptions of the offeror's technical approach for each phase and task of the program.

Offerors may submit proposals for both technical areas (Development and Evaluation), but are only selectable for one or the other. See Section III.C. – Other Eligibility Requirements for detailed information.

The Deep Learning program will seek to develop machine learning systems that can apply the same architecture and set of algorithms to multiple types of data and use its capabilities in identifying and correlating concepts, entities and events within the data and the internal representations of the machine to perform multiple tasks. Specifically, the program will expect Deep Learning Systems to exhibit cross-modal, multi-modal, and multi-task capabilities in three data domains: Audio/video (visual, audio, and sometimes, text within a spatio-temporal framework), sensor (extra-human perception), and language (text, audio, and some visual).

Specifically excluded are proposals based on multiple shallow learners that do not reflect the central architectural idea of a hierarchy of representations using a common set of algorithms.

Top Level Phase Descriptions

Phase 1: Demonstration of architecture feasibility using unlabeled data in the two domains of text and video.

Development Teams: Implement a basic Deep Learning System that demonstrates the construction of internal representations of regularities/entities/concepts in unlabeled input data using a layered learning architecture of at least three learned layers (not including layers that deal with sensory input, preprocessing, and output).

Evaluation Team: Provide initial test datasets to the Development Teams. Evaluate the quantity and quality of representations generated by the Development Teams' systems with regard to the metrics described below. Prepare test datasets, tasks, benchmarks, and tests for Phase 2 work.

Phase 2: Multi-task system demonstrations in three application domains. Phase 2 will emphasize the ability to apply the same learning engine to all three program domains and perform multiple tasks within each domain.

Development Teams: Implement a Deep Learning System based on the layered architecture of Phase 1 that, given appropriate preprocessing of unlabeled and labeled input data, can construct compact representations of input data in the three application areas outlined (audio/visual, sensor, and language) and apply the representations to the performance of multiple tasks appropriate to each application area.

Evaluation Team: Evaluate the Development Teams' systems across applications, and in multiple tasks with regard to the metrics described below. Prepare multimodal test datasets, tasks, benchmarks, and tests for Phase 3 work.

Phase 3: Multi-modal, multi-task demonstrations

Development Teams: Develop a Deep Learning System based on the results of Phase 2 that can use multi-modal datasets to improve learning and task performance over that achieved in Phase 2.

Evaluation Team: Evaluate the performance of the Development Teams' systems in performing multiple tasks on multi-modal data with regard to the metrics described below.

Offerors must clearly demonstrate their team's ability to perform the tasks of the Deep Learning Program. See the requirements for demonstrating team capability in the Additional Proposal Information Section and in Section IV.B.2. - Proposal Details. Proposals shall address a full system solution that incorporates the relevant tasks of each of the three phases of the program. Funding for subsequent phases will be contingent upon satisfactorily meeting the operational metrics of each completed phase

and the availability of funds, among other program considerations. See the Go/No-Go Metrics section for further information.

PROGRAM STRUCTURE (technical areas, phase and task descriptions)

As stated above, the envisioned Deep Learning program has three phases that consist of the following tasks.

Currently, Phases 1 and 2 are planned for 18 months each and Phase 3 is planned for 12 months. Phase 1 will commence with a program kick-off meeting. Phases 2 and 3 will commence upon the conclusion of the preceding phase, dependent on DARPA approval of continuing the program. It is anticipated that there will be multiple Development Teams, with down-selects occurring at the end of Phase 1 and Phase 2. It is further anticipated that there will be one Evaluation Team that will perform across all phases. Not all Development Teams may qualify for advancement to subsequent phases even if they meet the Go/No-Go criteria for each phase. Performance relative to other teams and other criteria may be applied to aid in down-selects at the discretion of DARPA. Any additional criteria to be used for down-selects will be specified by DARPA at the start of each phase of the program. DARPA and the Evaluation Team will confer on these criteria, but DARPA reserves the right to make final decisions. The Evaluation Team will develop tests, as needed, to enable evaluation of additional criteria. Development Teams must have their systems ready for evaluation no less than 45 days prior to the end of each phase.

Phases 1 and 2 will conclude with a joint meeting of Development Team principal investigators, the Evaluation Team's principal investigator, and DARPA program management to discuss the results of the completed Phase and plans for the next Phase. Participation in this meeting does not guarantee that DARPA will fund a subsequent Phase, or that if DARPA does fund the subsequent phase that a Development Team participating in the meeting will participate in that subsequent Phase.

Phase 3 will conclude with the submission of Deliverables (see Deliverables Section below) and a joint meeting of the Development Teams' principal investigator(s), the Evaluation Team's principal investigator, and DARPA program management.

Phase 1: Demonstration of architecture's feasibility with unlabeled data

The emphasis in Phase 1 is on proving architectural/algorithmic effectiveness in terms of ability to use unlabeled data to produce useful representations and classifications.

The Development Teams will use test datasets provided by the Evaluation Team at the beginning of Phase 1. Results will be evaluated against best published results, if any, using shallow methods for those datasets. The Evaluation Team will, in addition, verify the best published results and, possibly, improve on these results using their own shallow method. Results of each team will also be evaluated relative to those of other teams.

Table 2 – Example Test Datasets shown in Section VIII.C. lists existing datasets that represent the variety of data that may be chosen for use in the Deep Learning program, together with examples of tasks. DARPA may choose to use datasets and specify tasks not listed in this table. Evaluation Team offerors may choose to propose:

- datasets from this list,
- other existing datasets,
- the enhancement of existing datasets, or
- the creation of entirely new datasets.

The examples given are not all inclusive and are not intended to lead offerors to propose these specific datasets, or to suggest that the tasks listed will be assigned in the program. Offerors are encouraged to submit proposals that will advance the state of the art and address the multi-task, multi-modal objectives of the Deep Learning program. One goal of the Deep Learning program is the advancement of Defense-related computer science to maintain U.S. technological superiority. As such, the program intends to make publicly available to the larger machine-learning community the results of the research, including many, if not all, of the algorithms, software, datasets, and evaluation methods developed under the program.

DARPA plans two system evaluations during this phase. The first evaluation will be an interim status assessment, performed by DARPA in collaboration with the Evaluation Team, which will occur roughly halfway through the phase. The main goal of this assessment will be to expose potential failures and identify potential causes and any other issues so that the Development Teams can correct them. The second evaluation will occur toward the end of the phase.

The conceptual diagram below in Figure 3 notionally depicts a layered learning system and the compact, intermediate representation codes it might produce from unlabeled data. This method uses an encoder to capture the information content of a stage and represent it as a code. A decoder stochastically reconstructs the content as a training signal before the code is passed to the next stage for further processing. A variety of mechanisms for creating increasingly useful representations are expected to be considered and proposed. The expectation is that representations will be generated from unlabeled data by the Development Teams and given to the Evaluation Team so they may assess the extent to which these representations improve learnability for tasks.

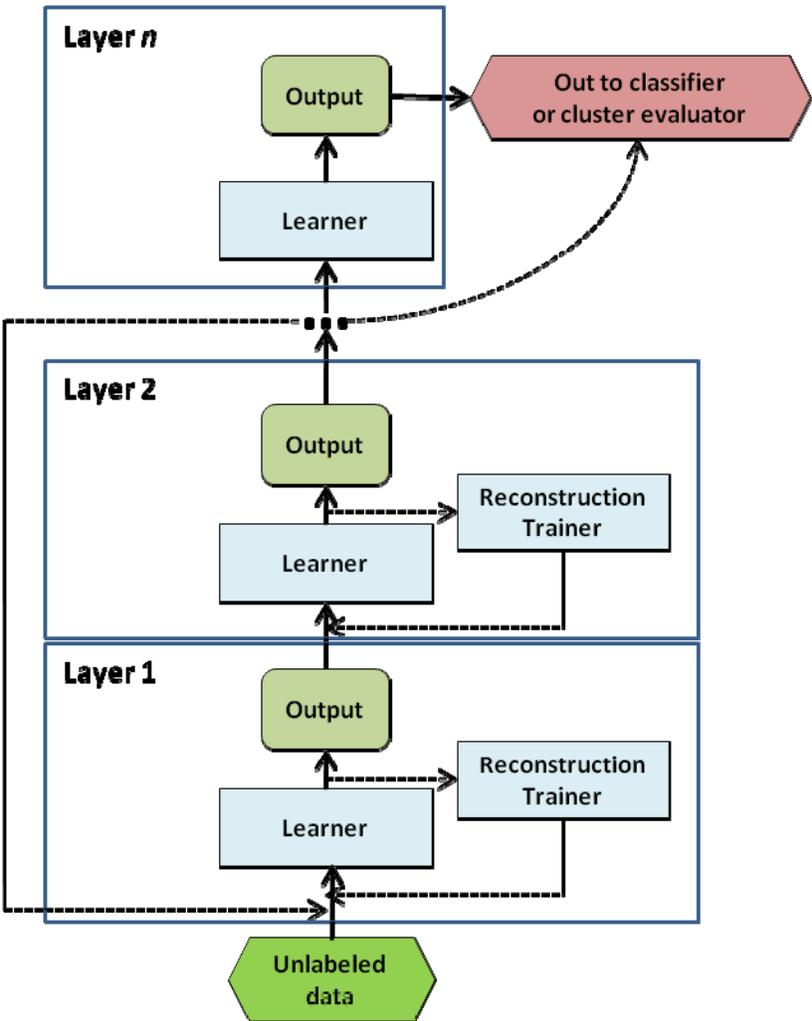


Figure 3 - Notional Intermediate Representations of a Deep Learning System

Development Team Phase 1 tasks

Construction of a Demonstration Deep Learning System

The Development Teams will use video and text data provided by the Evaluation Team to demonstrate that their system:

- a. Ingests unlabeled test data.
- b. Constructs internal representations, codes or concepts using an architecture that employs the same set of algorithms across at least three distinct layers.
- c. Provides the aforementioned representations as input into a simple linear classifier (provided by the Evaluation Team) whose output classification results are comparable in quality to a shallow state-of-the-art classifier system, such as an SVM using a task-specific kernel.

Proposals must describe an overall system architecture for a Deep Learning System and discuss technical challenges/issues and their plans to overcome these. Such

issues may include, but are not limited to: input/output interfaces, preprocessing of the data, and the correlation of the Core Deep Learner's internal and output representations with real-world entities in the input data streams.

Offerors should describe an evaluation plan for use of the representations formed from unlabeled data for the benefit of the Evaluation Team. The plan should be consistent with, but not necessarily limited to, the criteria discussed in the Go/No-Go Metrics section.

In addition, developers are expected to support the needs of the Evaluation Team by providing access to all developed system and component software; addressing software requirements for assessment of results; identifying failure causes, meeting required delivery dates to support evaluation events; and responding to any other test-related issues.

Data for training and evaluation will be provided by the Evaluation Team in two domains: video and text. For Phase 1, Development Teams may create a different Core Deep Learner for each of the two test domains. For later phases, the same Core Deep Learner must be used for all domains.

Evaluation Team Phase 1 tasks

Task 1 - Performance Evaluation:

The Evaluation Team will conduct the evaluations of all Deep Learning software in an independent and objective manner. The evaluation will consist of using the output representations created from the unlabeled data by the Development Teams' machines and submitting them to a simple linear classifier devised by the Development Team. This classifier will be limited in capability to separating classes in the feature space of the representations with hyperplanes in that space.

The Evaluation Team will attempt to reproduce the quality of the best published shallow method results, if any, for the test datasets using a shallow method classifier, such as an SVM, implemented by the Evaluation Team. The classification results of each Development Team's representations will be compared with the best published shallow method results for the dataset and with the best results of the Evaluation Team's shallow method classifier. The results of each Development Team will also be compared with those of the other Development Teams, and all results will be ranked by the Evaluation Team.

The Evaluation Team will assess system performance against the Go/No-Go criteria and any additional performance metrics as described in the Go/No-Go Metrics section. The Evaluation Team will provide a report on the results of the evaluation to DARPA, including a ranking of Development Team performance. To support each evaluation, the Evaluation Team will provide the Development Teams with the Phase 1 test datasets (one video, one text, both including ground truth annotations) as described above.

The Evaluation Team must be provided with access to all system and component software created by the Development Teams.

Task 2 – Dataset, Task, Benchmark, and Test Preparation to Support Phase 2

The Evaluation Team will prepare three test datasets to be used during Phase 2 of the Deep Learning program. These datasets will address each of the program’s domains: audio/video, sensor, and language.

As described above, offerors may propose to use existing datasets or create entirely new datasets. In either case, the Evaluation Team will be expected to provide a description of each test dataset and related information including:

- 1) A general description of the dataset’s contents
- 2) The size of the dataset in appropriate units
- 3) The format of the dataset, in a form suitable for representation in software
- 4) Ground truth annotations of the dataset to be used in the evaluation of system performance
- 5) A detailed description of the six tasks (two per program domain area) to be performed using the dataset. The description must be sufficient to allow the Development Teams to develop software for the execution of the tasks.
- 6) Benchmarks for performance of the prescribed tasks for the dataset created using “shallow methods.” The benchmarks should include:
 - a. Metrics indicating the quality of the shallow method implementations against which the Development Teams’ results can be compared
 - b. Metrics indicating the optimum amount of labeled data and supervision needed to train the shallow method implementations
- 7) A detailed description of the protocols to be used for testing

The Evaluation Team will work in close coordination with the Development Teams to define any necessary interface standards and to ensure test operability. The Evaluation Team will be responsible for refining the system-level performance metrics (described in the Go/No-Go Metrics Section below) as required. Phase 1 requires the Evaluation Team to use a simple linear classifier as a measure of learnability, but other methods, such as cluster quality metrics, may be proposed.

Phase 2: Demonstration of multiple task performance in three application areas using the same Core Deep Learner

Phase 2 will emphasize the ability to apply the same learning engine to all three program domains and perform multiple tasks within each domain.

During Phase 2, the Development Teams will use a portion of each dataset (prepared by the Evaluation Team), to train and test their Core Learner, and will add additional components to their systems to enable performance of the specified tasks.

DARPA plans two system evaluations during this phase. The first evaluation will be an interim status assessment, performed by DARPA in collaboration with the Evaluation Team, which will occur roughly halfway through the phase. The main goal of this assessment will be to expose potential failures and identify potential causes and any other issues so that the Development Teams can correct them. The second evaluation will occur toward the end of the phase and will assess system performance, using the test datasets, benchmarks, and tests prepared by the Evaluation Team during Phase 1 against the Go/No-Go criteria and the additional performance metrics described in the Go/No-Go Metrics section.

At phase end, the Evaluation Team will monitor system runs and certify performance relative to the Evaluation Team's shallow method benchmarks and the Program's Go/No-Go metrics. These evaluations will use the full test datasets prepared by the Evaluation Team.

The results of each Development Team will also be compared with those of the other Development Teams, and the results will be ranked by the Evaluation Team.

The Evaluation Team will work in close coordination with the Development Teams to define any necessary interface standards and to ensure operability within the test environment. The Evaluation Team will be responsible for refining the system-level performance metrics (described in the Go/No-Go Metrics Section) as required.

Development Team Phase 2 tasks

Construction of an application-agnostic, cross-modal, multi-task Deep Learning System

Performers must demonstrate that their system can utilize the three test datasets provided by the Evaluation Team in the performance of the six tasks specified by the Evaluation Team. The purpose of this exercise is to establish that the architecture and algorithms implemented in the Deep Learning system can be successfully applied to multiple modalities/application areas given only changes to preprocessing.

Proposals should discuss technical challenges/issues and their plans to overcome these. Such issues may include, but are not limited to: input/output interfaces, preprocessing of the data, correlation of machine representations with real-world

entities in the input data streams, limitations affecting task execution, and limitations affecting spatio-temporal representation.

Offerors must describe a plan for meeting the objectives of the Phase, addressing the technical challenges/issues, and meeting the criteria discussed in the Go/No-Go Metrics section.

In addition, developers are expected to support the needs of the Deep Learning Evaluation Team by providing access to all developed system and component software; addressing software instrumentation needs; identifying failure causes, meeting required delivery dates to support evaluation events; and responding to any other test-related issues.

Evaluation Team Phase 2 tasks

Task 1 - Performance Evaluation:

As in Phase 1, the Evaluation Team will conduct the evaluations of all Deep Learning software in an independent and objective manner.

The Evaluation Team will provide a report on the results of the two system evaluations to DARPA, including a ranking of Development Team performance.

To support each evaluation, the Evaluation Team will be provided with access to all system and component software developed by the Development Teams.

Task 2— Dataset, Task, Benchmark, and Test Preparation to Support Phase 3

The Evaluation Team will prepare three multi-modal test datasets to be used during Phase 3 of the Deep Learning program. These datasets will address each of the program's domains: video, sensor, and language.

A multi-modal dataset, in the context of the Deep Learning program, is a dataset that encodes multiple sensory inputs occurring within the same spatio-temporal frame such that the sensor streams can be temporally matched on replay. Video formats, such as Digital Video (DV), that encode image sequences and audio tracks are examples of multi-modal datasets. Videos that record newscasts with accompanying "crawls" or closed captions can be considered tri-modal datasets (image, audio, and text). Devices contributing to a multi-modal dataset do not have to be co-located. For example, ground-based audio or seismic data might be combined with overhead imagery, so long as they were recorded at the same time.

Offerors may propose to use existing datasets or create entirely new datasets. In either case, the Evaluation Team will be expected to provide a description of each dataset and related information including:

- 1) A general description of the dataset's contents

- 2) The size of the dataset in appropriate units
- 3) The format of the dataset, in a form suitable for representation in software
- 4) Ground truth annotations of the dataset to be used in the evaluation of system performance
- 5) A detailed description of the six tasks (two per program domain area) to be performed using the dataset. The description must be sufficient to allow the Development Teams to develop software for the execution of the tasks.
- 6) Benchmarks for performance of the prescribed tasks for the dataset created using “shallow methods.” The benchmarks should include:
 - a. Metrics indicating the quality of the shallow method implementations against which the Development Teams’ results can be compared
 - b. Metrics indicating the optimum amount of labeled data and supervision needed to train the shallow method implementations
- 7) A detailed description of the protocols to be used for testing

The Evaluation Team will work in close coordination with the Development Teams to define any necessary interface standards and to ensure test operability. The Evaluation Team will be responsible for refining the system-level performance metrics (described in the Go/No-Go Metrics Section) as required.

Phase 3: Demonstration of enhanced multi-task performance using concurrent inputs from multiple modalities

Phase 3 will emphasize the ability to combine the construction of representations from multiple, concurrent sensory inputs and utilize that capability to enhance task performance. It is expected that Phase 3 will require a high degree of spatio-temporal representation and processing in order to successfully accomplish the phase’s tasks.

During Phase 3, the Development Teams will use a portion of each dataset, selected and provided by the Evaluation Team, to train and test their Core Learner, and will add additional components to their system to enable performance of the specified tasks.

At phase end, the Evaluation Team will monitor system runs and certify performance relative to the Evaluation Team’s shallow method benchmarks and the Program’s Go/No-Go metrics. These evaluations will use the full test datasets prepared by the Evaluation Team.

The Evaluation Team will work in close coordination with the Development Teams to define any necessary interface standards and to ensure operability within the test

environment. The Evaluation Team will be responsible for refining the system-level performance metrics (described in the Go/No-Go Metrics Section) as required.

Development Team Phase 3 tasks

Construction of a multi-modal, multi-task Deep Learning System

Performers must demonstrate that their system can utilize the three test datasets provided by the Evaluation Team in the performance of the six tasks specified by the Evaluation Team. The purpose of this exercise is to establish that the architecture and algorithms implemented in the Deep Learning System can improve their performance through the use of multi-modal data.

Proposals should discuss technical challenges/issues and their plans to overcome these. Such issues may include, but are not limited to: input/output interfaces, preprocessing of the data, correlation of machine representations with real-world entities in the input data streams, and correlations of machine representations across modalities.

Offerors should describe a plan for meeting the objectives of the phase, addressing the technical challenges/issues, and meeting the criteria discussed in the Go/No-Go Metrics section.

In addition, developers are expected to support the needs of the Deep Learning Evaluation Team by providing access to all developed system and component software; addressing software instrumentation needs; identifying failure causes, meeting required delivery dates to support evaluation events; and responding to any other test-related issues.

Evaluation Team Phase 3 Tasks

Performance Evaluation

The Evaluation Team will evaluate the systems and components developed by the Development Teams. These evaluations will be conducted in an independent and objective manner.

DARPA plans a single system evaluation toward the end of this phase. The evaluation will assess system performance, using the datasets, benchmarks, and tests prepared by the Evaluation Team during Phase 2 against the Go/No-Go criteria and the additional performance metrics described in the Go/No-Go Metrics section.

To support each evaluation, the Evaluation Team will be provided with access to all system and component software developed by the Development Teams.

DELIVERABLES

Development Teams:

Within 60 days following each phase conclusion, all Development Teams are expected to submit to the Government the following deliverables:

- All software and supporting documentation developed in the program.
- A written final report of their activities and accomplishments.

Evaluation Teams:

Within 30 days following each phase conclusion, the Evaluation Team is expected to submit to the Government the following deliverables:

- All test datasets and supporting information, including ground truth annotations.
- Evaluations of all Development Team results.
- All software and supporting documentation developed in the program.
- A written final report of its activities and accomplishments, a comparative summary of Development Team results, and the Evaluation Team's conclusions regarding the results of the Development Teams and the program.

Intellectual Property rights will be considered as part of proposal evaluation. In general, less restrictive rights will be considered favorably. Since the research value to DARPA of a deliverable depends upon the collective availability of its constituents, licensing models will be evaluated, in part, in terms of their most restrictive provisions in the context of Deep Learning program goals. As indicated previously, a key objective in this program is to promote the development and extension of innovative machine-learning technologies. Therefore, licensing models that avoid barriers to this objective will be viewed favorably. If the proposed licensing model poses restrictions that conflict with program goals, the offeror should recommend an amelioration strategy (e.g., open source alternatives, research versions, etc.). **The Government will carefully assess the advantages and disadvantages of proposed licensing models within the context of their intended use(s) in the program.**

If offerors include background proprietary software and data as the basis of their proposed approach, they must outline in detail any future costs or legal obligations that the Government would incur from utilizing the proprietary information, including, wherever possible, attaching proposed licensing agreements for reference purposes. Offerors expecting to utilize, but not to deliver, open source tools or other materials in implementing their approach must

ensure that the government does not incur any legal obligation due to such utilization. See VI.B.2 – Intellectual Property for further information.

GO/NO-GO METRICS

Proposals must reflect a quantitative understanding of the performance Go/No-Go metrics and the statistical confidence with which they may be measured.

The work of Deep Learning Development Teams will be reviewed by the Evaluation Team and DARPA at the end of each phase to determine whether the Go/No-Go criteria have been satisfactorily achieved. The Go/No-Go reviews will be the principal basis for establishing eligibility to continue into the next program phase at the conclusion of Phases 1 and 2. In their proposal, offerors must provide a thorough explanation of how each of these gate metrics will be met.

Table 1, below, defines the metrics that will be used to assess the technical performance of the Development Teams for each phase. In addition to the quantitative measures specified in the table, Development Teams will be compared to one another as an additional evaluation criterion.

Due to the innovative nature of the proposed work and the difficulty of anticipating fruitful approaches, offerors for both Development Teams and the Evaluation Team are encouraged to propose additional criteria and Go/No-Go metrics with which to assess the performance of the Development Team. These additional criteria are for judging the quality of the representations created by the Deep Learning systems developed. The criteria may be different for different phases and should apply to unlabeled data in Phase 1, multi-task learning in Phase 2, and multi-modal data in Phase 3.

Metrics	Phase 1	Phase 2	Phase 3
Correspondence of machine representations with ground truth	Must achieve results using representations from unlabeled data into a simple linear classifier comparable to best published results using shallow methods and labeled data	No more than 10% greater error than that achieved by Evaluation Team using shallow methods	At least 10% less error than that achieved by Evaluation Team using shallow methods
Labeled Data	No labeled data for creation of representations. Labels used only by ET for simple classifier.	Use average of 50% less labeled data than shallow benchmarks	Use average of 75% less labeled data than shallow benchmarks
Task performance	Representations learned from a deep system and a simple classifier are comparable to those of the best shallow classifier	Demonstrate performance of two tasks using each of three input modalities/ application areas	Demonstrate that multiple, simultaneous modalities can improve overall performance on the other metrics

Table 1 – Go/No-Go Metrics for the Deep Learning Development Teams

ADDITIONAL PROPOSAL INFORMATION

Cost Proposals must outline any costs associated with acquiring the test datasets.

Offerors for Development Teams must show the ability to perform innovative research in deeply layered learning either by referencing their own published work or by including unpublished results on test datasets within, or attached to, the body of their proposal. Proposals that do not show such capability will not be considered. Specifically excluded are references or inclusions based only on shallow learners.

Offerors for the Evaluation Team must show ability to perform shallow classification experiments on test datasets in both text and vision domains by referencing their own published work or by including unpublished results on test datasets within, or attached to, the body of their proposal. Proposals that do not show such capability will not be considered. References or inclusions based on shallow learners are permitted.

Teams may have any organizational structure capable of performing the work. However a team is structured, a specific individual and institution with overall

responsibility for team performance—including interactions between the Development team, DARPA, and the Evaluation Team—must be identified.

II. AWARD INFORMATION

DARPA anticipates awards to several Development Teams with alternative approaches to achieving the technical goals of the Deep Learning Program. DARPA anticipates a single award for an Evaluation Team.

The amount of resources made available to this BAA will depend on the quality of the proposals received and the availability of funds. The Government reserves the right to select for negotiation all, some, one, or none of the proposals received in response to this solicitation, and to make awards without discussions with offerors. The Government also reserves the right to conduct discussions if it is later determined to be necessary. If warranted, portions of resulting awards may be segregated into pre-priced options. Additionally, DARPA reserves the right to accept proposals in their entirety or to select only portions of proposals for award. In the event that DARPA desires to award only portions of a proposal, negotiations may be opened with that offeror. The Government reserves the right to fund proposals in phases with options for continued work at the end of one or more of the phases.

Awards under this BAA will be made to offerors on the basis of the evaluation criteria listed below (see Section V. - Application Review Information), and program balance to provide overall value to the Government. Proposals identified for negotiation may result in a procurement contract, cooperative agreement, or other transaction depending upon the nature of the work proposed, the required degree of interaction between parties, and other factors. The Government reserves the right to request any additional, necessary documentation once it makes the award instrument determination. Such additional information may include but is not limited to Representations and Certifications. The Government reserves the right to remove proposers from award consideration should the parties fail to reach agreement on award terms, conditions and cost/price within a reasonable time or the proposer fails to timely provide requested additional information. As of the date of publication of this BAA, DARPA expects that program goals for this BAA may be met by offerors intending to perform 'fundamental research,' i.e., basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community, as distinguished from proprietary research and from industrial development, design, production, and product utilization the results of which ordinarily are restricted for proprietary or national security reasons. Notwithstanding this statement of expectation, DARPA is not prohibited from considering and selecting research proposals that, while perhaps not qualifying as 'fundamental research' under the foregoing definition, still meet the BAA criteria for submissions. In all cases, the contracting officer shall have sole discretion to select award instrument type and to negotiate all instrument provisions with selectees.

III. ELIGIBILITY INFORMATION

A. Eligible Applicants

All responsible sources capable of satisfying the Government's needs may submit a proposal that shall be considered by DARPA. Historically Black Colleges and Universities (HBCUs), Small Businesses, Small Disadvantaged Businesses and Minority Institutions (MIs) are encouraged to submit proposals and join others in submitting proposals; however, no portion of this announcement will be set aside for these organizations' participation due to the impracticality of reserving discrete or severable areas of this research for exclusive competition among these entities.

Government-funded entities (Federally Funded Research and Development Centers (FFRDCs), Government/National laboratories) and Government entities (military educational institutions, etc.) are subject to applicable direct competition limitations and cannot propose to this BAA in any capacity (as prime or sub) unless they meet the following conditions.

- FFRDCS must clearly demonstrate that the work is not otherwise available from the private sector AND they must also provide a letter on letterhead from their sponsoring organization citing the specific authority establishing their eligibility to propose to government solicitations in compliance with the associated FFRDC sponsor agreement terms and conditions. This information is required for FFRDCs proposing to be prime or subcontractors.
- Government entities must clearly demonstrate that the work is not otherwise available from the private sector and provide written documentation citing the specific statutory authority (as well as, where relevant, contractual authority) establishing their ability to propose to Government solicitations.
- At the present time, DARPA does not consider 15 U.S.C. 3710a to be sufficient legal authority to show eligibility. While 10 U.S.C. 2539b may be the appropriate statutory starting point for some entities, specific supporting regulatory guidance, together with evidence of agency approval, will still be required to fully establish eligibility.

DARPA will consider eligibility submissions on a case-by-case basis; however, the burden to prove eligibility for all team members rests solely with the offeror.

Foreign participants and/or individuals may participate to the extent that such participants comply with any necessary Non-Disclosure Agreements, Security Regulations, Export Control Laws, and other governing statutes applicable under the circumstances.

Applicants considering classified submissions (or requiring access to classified information during the life-cycle of the program) shall ensure all industrial, personnel, and information system processing security requirements are in place and at the appropriate level (e.g., Facility Clearance (FCL), Personnel Security Clearance (PCL), certification and accreditation (C&A)) and any Foreign Ownership Control and Influence

(FOCI) issues are mitigated prior to such submission or access. Additional information on these subjects can be found at: www.dss.mil.

1. Procurement Integrity, Standards of Conduct, Ethical Considerations, and Organizational Conflicts of Interest

Current federal employees are prohibited from participating in particular matters involving conflicting financial, employment, and representational interests (18 USC 203, 205, and 208.). The DARPA Program Manager for this BAA is Dr. Josh Alspector.

As of the date of first publication of the BAA, the Government has not identified any potential conflicts of interest involving this program manager. Once the proposals have been received, and prior to the start of proposal evaluations, the Government will assess potential conflicts of interest and will promptly notify the offeror if any appear to exist. (Please note the Government assessment does NOT affect, offset, or mitigate the offeror's own duty to give full notice and planned mitigation for all potential organizational conflicts, as discussed below.) The Program Manager is required to review and evaluate all proposals received under this BAA and to manage all selected efforts. Offerors should carefully consider the composition of their performer team before submitting a proposal to this BAA.

In accordance with FAR 9.503 and without prior approval or a waiver from the DARPA Director, a contractor cannot simultaneously be a SETA and a performer. Therefore, all offerors and proposed subcontractors must affirm whether they (their organizations and individual team members) are providing scientific, engineering, and technical assistance (SETA) or similar support to any DARPA technical office(s) through an active contract or subcontract. All affirmations must state which office(s) the offeror, sub and/or individual supports and identify the prime contract numbers. Affirmations shall be furnished at the time of proposal submission. All facts relevant to the existence or potential existence of organizational conflicts of interest (FAR 9.5) must be disclosed. The Government will make the final determination on what constitutes a conflict of interest. The disclosure shall include a description of the action the offeror has taken or proposes to take to avoid, neutralize, or mitigate such conflict. **Proposals that fail to fully disclose potential conflicts of interests and/or do not have plans to mitigate this conflict will be rejected without technical evaluation and withdrawn from further consideration for award.**

If a prospective offeror has any questions on what constitutes a conflict of interest (whether organizational or otherwise), the offeror should promptly raise the issue with DARPA by sending his/her contact information and a summary of the potential conflict by email to the mailbox address for this BAA at DARPA-BAA-09-40@darpa.mil, before time and effort are expended in preparing a proposal and mitigation plan. If, in the sole opinion of the Government after full consideration of the circumstances, any conflict situation cannot be effectively mitigated, the proposal may be rejected without technical evaluation and withdrawn from further consideration for award under this BAA.

B. Cost Sharing or Matching

Cost sharing is not required for this particular program; however, cost sharing will be carefully considered where there is an applicable statutory condition relating to the selected funding instrument (e.g., for any Technology Investment Agreement under the authority of 10 U.S.C. 2371). Cost sharing is encouraged where there is a reasonable probability of a potential commercial application related to the proposed research and development effort.

C. Other Eligibility Requirements

A performer selected for the Evaluation Team, will not and cannot be selected for any portion of the Development Team, whether as a prime or subcontractor or in any other capacity; therefore, if DARPA selects your proposal for the Evaluation Team, your proposal submitted for the Development Team will be considered as “not selectable” even if it would otherwise have been considered “selectable” according to the evaluation criteria. This is to avoid organizational conflict of interest situations between technical and evaluation efforts and to ensure objective test and evaluation results. The Government reserves the right to choose which task proposal to select and which not to select, in cases where an offeror has submitted otherwise selectable proposals to both tasks.

IV. APPLICATION AND SUBMISSION INFORMATION

A. Address to Request Application Package

This solicitation contains all information required to submit a proposal. No additional forms, kits, or other materials are needed other than as noted within this document. This notice constitutes the total BAA. No additional information is available, nor will a formal Request for Proposal (RFP) or additional solicitation regarding this announcement be issued. Requests for same will be disregarded.

B. Content and Form of Application Submission

1. Proposal Information

DARPA will employ an electronic upload submission system for all responses to this BAA. Responding to this announcement requires completion of an online cover sheet for each proposal prior to submission. To do so, the offeror must go to <https://www.csc-ballston.com/baa/index.asp?BAAid=09-40> and follow the instructions there. Upon completion of the online cover sheet, a Confirmation Sheet will appear along with instructions on uploading proposals. The Confirmation Sheet will be used as the Cover Sheet for the proposal and will contain the information outlined below in Proposal Section 1.1. If an offeror intends to submit more than one proposal, a unique UserID and password must be used in creating each cover sheet. **Since offerors may encounter heavy traffic on the web server, they SHOULD NOT wait until the day the proposal is due to fill out a coversheet and submit the proposal!**

2. Proposal Preparation and Format

The proposal shall be delivered in two volumes, Volume 1 (technical proposal) and Volume 2 (cost proposal). Proposals not meeting the format described in this BAA may not be reviewed.

All proposals must be zipped and encrypted using Winzip or PKZip with 256-bit AES encryption. Only one zipped/encrypted file will be accepted per proposal. Proposals which are not zipped/encrypted will be rejected by DARPA. An encryption password form must be completed and emailed to DARPA-BAA-09-40@darpa.mil at the time of proposal submission. See https://www.CSC-Ballston.com/baa/Encryption_Instructions.htm for the encryption password form and additional encryption information. Note: the word "PASSWORD" must appear in the subject line of the above email and there are minimum security requirements for establishing the encryption password. Failure to provide the encryption password will result in the proposal not being evaluated.

Volume 1 – Technical Proposal

The technical proposal shall include the following sections, each starting on a new page (where a "page" is 8-1/2 by 11 inches with type not smaller than 12 point, margins not smaller than 1 inch, and line spacing not smaller than single-spaced). All submissions must be in English. Individual elements of the proposal shall not exceed the total of the maximum page lengths for each section as shown in braces { } below.

Ensure that each section provides the detailed discussion of the proposed work necessary to enable an in-depth review of the specific technical and managerial issues. Specific attention must be given to addressing both risk and payoff of the proposed work that make it desirable to DARPA.

Proposal Section 1. Administrative

1.1 Confirmation Sheet/Cover Sheet

As described above, this cover sheet will contain the following information:

- BAA number;
- Proposal title;
- Technical Area: Development or Evaluation;
- Technical point of contact including: name, telephone number, electronic mail address, fax (if available) and mailing address;
- Administrative point of contact including: name, telephone number, electronic mail address, fax (if available) and mailing address;
- Summary of the costs of the proposed research, including total base cost, estimates of base cost in each year of the effort, estimates of itemized options in each year of the effort, and cost sharing if relevant;
- Contractor's reference number (if any)
- Contractor's type of business, selected from among the following categories:
 - WOMEN-OWNED LARGE BUSINESS,

- OTHER LARGE BUSINESS,
- SMALL DISADVANTAGED BUSINESS [Identify ethnic group from among the following: Asian-Indian American, Asian-Pacific American, Black American, Hispanic American, Native American, or Other],
- WOMEN-OWNED SMALL BUSINESS,
- OTHER SMALL BUSINESS,
- HBCU,
- MI,
- OTHER EDUCATIONAL,
- OTHER NONPROFIT, OR
- FOREIGN CONCERN/ENTITY.

1.2 Table of contents {No page limit}

Proposal Section 2. Technical Details

2.1 PowerPoint summary chart {1 chart}:

Provide a one slide summary of the proposal in PowerPoint that effectively and succinctly conveys the main objective, key innovations, expected impact, and other unique aspects of the proposal.

2.2 Innovative claims for the proposed research {3 Pages}:

These pages are the centerpiece of the proposal and should succinctly describe the unique proposed approach and contributions.

2.3 Proposal Roadmap {2 Pages}:

The roadmap provides a top-level view of the content and structure of the proposal. It contains a synopsis for each of the roadmap areas defined below, which should be elaborated elsewhere. It is important to make the synopses as explicit and informative as possible. The roadmap must also cross-reference the proposal page number(s) where each area is elaborated. The required roadmap areas are:

- a. Main goals of the proposed research.
- b. Tangible benefits to end users (i.e., benefits of the capabilities afforded if the proposed technology is successful).
- c. Critical technical barriers (i.e., technical limitations that have, in the past, prevented achieving the proposed results).
- d. Main elements of the proposed technical approach.
- e. Basis of confidence (i.e. rationale that builds confidence that the proposed approach will overcome the technical barriers).
- f. Nature and description of end results to be delivered to DARPA. In what form will results be developed and delivered to DARPA and the scientific community? Note that DARPA encourages experiments, simulations, specifications, proofs, etc. to be documented and published to promote progress in the field. Offerors should specify both final and intermediate products.
- g. Cost and schedule of the proposed effort.

2.4 Technical Approach {20 pages}:

Provide a detailed description of the technical approach. Teams may choose to allocate the pages among the program phases unequally; however, separate sections are required for each phase. This section will elaborate on many of the topics identified in the proposal roadmap and will serve as the primary expression of the offerors' scientific and technical ideas.

2.5 Statement of Work (SOW) {5 pages}:

In plain English, clearly define the technical tasks to be performed, their durations, and dependencies among them. For each task, provide:

- A general description of the objective (for each defined task/activity);
- A detailed description of the approach to be taken to accomplish each defined task/activity);
- Identification of the primary organization responsible for task execution (prime, sub, team member, by name, etc.);
- The exit criteria for each task/activity - a product, event or milestone that defines its completion.
- Define all deliverables (reporting, data, reports, software, etc.) to be provided to the Government in support of the proposed research tasks/activities.

Note: The SOW should be developed so that each phase of the program is separately defined. Offerors should format their proposals with Phase 1 as the Base and Phases 2 and 3 as options. Do not include any proprietary information in the SOW.

2.6 Deliverables Description {3 Pages}:

List and provide, by phase, a detailed description for each proposed deliverable, including receiving organization and expected delivery date for each deliverable. Include in this section all proprietary claims to results, prototypes, or systems supporting and/or necessary for the use of the research, results, and/or prototype. If there are no proprietary claims, this should be stated. The offeror must submit a separate list of all technical data or computer software that will be furnished to the Government with other than unlimited rights. See section VI.B.2 - Intellectual Property for more information.

2.7 Management Plan {4 Pages}:

Describe formal teaming agreements that are required to execute this program, a brief synopsis of all key personnel, and a clearly defined organization chart for the program team (prime contractor and subcontractors, if any). Provide an argument that the team size and composition are both necessary and sufficient to meet the program objectives. Provide detailed task descriptions, costs, and interdependencies for each individual effort and/or subcontractor. To the extent that graduate students and postdocs are involved in individual efforts, describe their role and contribution. Information in this section must cover the following information:

- a. Programmatic relationship of team members;
- b. Unique capabilities of team members;
- c. Task responsibilities of team members;

- d. Teaming strategy among the team members;
- e. Key personnel along with the amount of effort to be expended by each person during each year;
- f. To the extent that graduate students and postdocs are involved in individual efforts, describe their role and contribution; and
- g. Government role in project, if any.

2.8 Schedule and Milestones:

This section should include:

- a. {1 Page} Schedule Graphic. Provide a graphic representation of project schedule including detail down to the individual effort level. This should include but not be limited to, a multi-phase development plan, which demonstrates a clear understanding of the proposed research; and a plan for periodic and increasingly robust tests over the project life that will show applicability to the overall program concept. Show all project milestones. Use “x months after contract award” designations for all dates.
- b. {3 Pages} Detailed Task Descriptions. Provide detailed task descriptions for each discrete work effort and/or subcontractor in schedule graphic.
- c. {1 Page} Project Management and Interaction Plan. Describe the project management and interaction plans for the proposed work. If proposal includes subcontractors that are geographically distributed, clearly specify working / meeting models. Items to include in this category include software/code repositories, physical and virtual meeting plans, and online communication systems that may be used.

2.9 Personnel, Qualifications, and Commitments {NO MORE THAN ONE PAGE PER KEY PERSON}:

List key personnel, showing a concise summary of their qualifications, discussion of offeror’s previous accomplishments, and work in this or closely related research areas. Indicate the level of effort in terms of hours to be expended by each person during each contract year and other (current and proposed) major sources of support for them and/or commitments of their efforts. DARPA expects all key personnel associated with a proposal to make substantial time commitment to the proposed activity and the proposal will be evaluated accordingly. It is DARPA’s intention to put key personnel clauses into the contracts, so offerors should not bid personnel whom they do not intend to execute the contract.

Include a table of key individual time commitments as follows:

Key Individual	Project	Pending/Current	2009	2010	2011	2012
Jane Doe	Deep Learning	Proposed	ZZZ hours	UUU hours	WWW hours	XXX hours
	Project 1	Current	YYY hours	n/a	n/a	n/a
	Project 2	Pending	100	n/a	n/a	n/a

			hours			
John Deer	Deep Learning	Proposed	YYY hours	VVV hours	TTT hours	n/a

2.10 Organizational Conflict of Interest Affirmations and Disclosure {No page limit}

Per the instructions in Section III.A. - Procurement Integrity, Standards of Conduct, Ethical Considerations, and Organizational Conflicts of Interest, all offerors and proposed subcontractors must provide documentation showing whether they (their organizations and individual team members) are providing scientific, engineering, and technical assistance (SETA) or similar support to any DARPA technical office(s) through an active contract or subcontract. All affirmations must state which office(s) the offeror, sub and/or individual supports and identify the prime contract numbers.

If the offeror or any proposed sub IS providing SETA support as described (regardless of which DARPA technical office is being supported), then the offeror shall include a description of the action the offeror has taken or proposes to take to avoid, neutralize, or mitigate such conflict. The Government will make the determination of what constitutes a conflict of interest. If the offeror or any proposed sub IS NOT currently providing SETA support as described, then the offeror should simply state “NONE.”

Proposals that fail to fully disclose potential conflicts of interests or do not have acceptable plans to mitigate identified conflicts will be rejected without technical evaluation and withdrawn from further consideration for award.

2.11 Intellectual Property {No page limit}

Per section VI.B.2 – Intellectual Property, offerors responding to this BAA shall identify any intellectual property restrictions. If no restrictions are intended, then the offeror should state “NONE”.

2.12 Human use {No page limit}:

For all proposed research that will involve human subjects in the first year or phase of the project, the institution must provide evidence of or a plan for review by an Institutional Review Board (IRB) upon final proposal submission to DARPA. For further information on this subject, see Section VI.B.4 below. If human use is not a factor in a proposal, then the offeror should state “NONE.”

2.13 Statement of Unique Capability Provided by Government or Government-funded Team Member {No page limit}

Per section III.A. – Eligible Applicants, proposals which include Government or Government-funded entities (i.e., FFRDC’s, National laboratories, etc.) as prime, sub or team member, shall provide a statement which clearly demonstrates the work being provided by the Government or Government-funded entity team member is not otherwise available from the private sector. If none of the team members belongs to a Government or Government-funded entity, then the offeror should state “Not Applicable.”

2.14 Government or Government-funded Team Member Eligibility {No page limit}

Per section III.A. – Eligible Applicants, proposals which include Government or Government-funded entities (i.e., FFRDC’s, National laboratories, etc.) as prime, sub or team member shall provide documentation citing the specific authority which establishes they are eligible to propose to government solicitations: 1) statutory authority; 2) contractual authority; 3) supporting regulatory guidance; AND 4) evidence of agency approval . If no such entities are involved, then the offeror should state “None.”

2.15 Cost Summaries {No page limit}:

This section shall contain two tables: the first table must summarize the proposed costs but break them down by project task and phase, i.e., show the costs of each project task for each phase, by month, with the task labels on the y-axis and the three phases on the x-axis. It may be appropriate to create a subtotal under some closely related tasks. Table entries should contain the dollar figure and a percentage that specifies the percentage of that phase’s total costs that are allocated to said task.

The second table should show the costs broken down by prime/subcontractor by month, by phase, i.e., the labels of the prime/subcontractors should be on the y-axis and the three phases on the x-axis. Table entries should contain the dollar figure and a percentage that specifies the percentage of that phase’s total costs allocated to said prime or subcontractor. Offerors should format their proposals with Phase 1 as the Base and Phases 2 and 3 priced as options.

Proposal Section 3 - Additional Information

Offerors for Development Teams must show the ability to perform innovative research in deeply layered learning either by referencing their own published work or by including unpublished results on standard datasets within the body of their proposal. Up to three published papers or unpublished technical reports demonstrating this ability must be appended to, or referenced in, the proposal. Referenced papers and reports must be web-accessible by DARPA. Proposals that do not show such capability will not be considered.

Offerors for the Evaluation Team must show ability to perform shallow classification experiments on standard datasets in both text and vision domains by referencing their own published work or by including unpublished results on standard datasets within the body of their proposal. Up to three published papers or unpublished technical reports demonstrating this ability must be appended to, or referenced in, the proposal. Referenced papers and reports must be web-accessible by DARPA. Proposals that do not show such capability will not be considered.

Offerors should ensure that any proprietary information provided in this section of the proposal is clearly marked as such. See Section VI.B.1. – Security Classification and Proprietary Issues for further information.

Volume 2 – Cost Proposal

Cover sheet

- BAA number;
- Technical area: Development or Evaluation;
- Lead Organization Submitting proposal;
- Type of business, selected among the following categories: “LARGE BUSINESS”, “SMALL DISADVANTAGED BUSINESS”, “OTHER SMALL BUSINESS”, “HBCU”, “MI”, “OTHER EDUCATIONAL”, OR “OTHER NONPROFIT”;
- Contractor’s reference number (if any);
- Other team members (if applicable) and type of business for each;
- Proposal title;
- Technical point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), electronic mail (if available);
- Administrative point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), and electronic mail (if available);
- Award instrument requested: cost-plus-fixed-fee (CPFF), cost-award—no fee, cost sharing contract – no fee, or other type of procurement contract (*specify*), cooperative agreement, or other transaction;
- Place(s) and period(s) of performance;
- Total proposed cost separated by basic award and option(s) (if any);
- Name, address, and telephone number of the offeror’s cognizant Defense Contract Management Agency (DCMA) administration office (*if known*);
- Name, address, and telephone number of the offeror’s cognizant Defense Contract Audit Agency (DCAA) audit office (*if known*);
- Date proposal was prepared;
- DUNS number;
- TIN number; and
- Cage Code;
- Subcontractor Information; and
- Proposal validity period.

Detailed cost breakdown

Provide: (1) total program cost broken down by major cost items (direct labor, including labor categories; subcontracts; materials; other direct costs, overhead charges, etc.) and further broken down by task and phase; (2) major program tasks by fiscal year; (3) an itemization of major subcontracts and equipment purchases; (4) an itemization of any information technology (IT) purchase¹; (5) a summary of projected funding

• ¹ IT is defined as “any equipment, or interconnected system(s) or subsystem(s) of equipment that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the agency. (a) For purposes of this definition, equipment

requirements by month; and (6) the source, nature, and amount of any industry cost-sharing; and (7) identification of pricing assumptions of which may require incorporation into the resulting award instrument (e.g., use of Government Furnished Property/Facilities/Information, access to Government Subject Matter Expert/s, etc.).

The prime contractor is responsible for compiling and providing all subcontractor proposals for the Procuring Contracting Officer (PCO). Subcontractor proposals should include Interdivisional Work Transfer Agreements (ITWA) or similar arrangements. Where the effort consists of multiple portions which could reasonably be partitioned for purposes of funding, these should be identified as options with separate cost estimates for each. NOTE: for IT and equipment purchases, include a letter stating why the offeror cannot provide the requested resources from its own funding.

Supporting cost and pricing information in sufficient detail to substantiate the summary cost estimates above. Include a description of the method used to estimate costs and supporting documentation. Note: "cost or pricing data" as defined in FAR Subpart 15.4 shall be required if the offeror is seeking a procurement contract award of \$650,000 or greater unless the offeror requests an exception from the requirement to submit cost or pricing data. "Cost or pricing data" are not required if the offeror proposes an award instrument other than a procurement contract (e.g., a cooperative agreement or other transaction.) All proprietary subcontractor proposal documentation, prepared at the same level of detail as that required of the prime, shall be made immediately available to the Government, upon request, under separate cover (i.e., mail, electronic/email, etc.), either by the offeror or by the subcontractor organization.

All offerors requesting an 845 Other Transaction Authority for Prototypes (OTA) agreement must include a detailed list of payment milestones. Each such payment milestone must include the following: milestone description, exit criteria, due date, milestone payment amount (to include, if cost share is proposed, Contractor and government share amounts). It is noted that, at a minimum, such payable milestones should relate directly to accomplishment of program technical Go/No-Go metrics as defined in the BAA and/or the offeror's proposal. Agreement type, fixed price or expenditure based, will be subject to negotiation by the Agreements Officer; however, it is noted that the Government prefers use of fixed price payable milestones to the maximum extent possible. If the offeror requests award of an 845 OTA agreement as a nontraditional defense Contractor, as so defined in the OSD guide entitled "Other

is used by an agency if the equipment is used by the agency directly or is used by a contractor under a contract with the agency which – (1) Requires the use of such equipment; or (2) Requires the use, to a significant extent, or such equipment in the performance of a service or the furnishing of a product. (b) The term "information technology" includes computers, ancillary, software, firmware and similar procedures, services (including support services), and related resources. (c) The term "information technology" does not include – (1) Any equipment that is acquired by a contractor incidental to a contract; or (2) Any equipment that contains imbedded information technology that is used as an integral part of the product, but the principal function of which is not the acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information. For example, HVAC (heating, ventilation, and air conditioning) equipment such as thermostats or temperature control devices, and medical equipment where information technology is integral to its operation, are not information technology."

Transactions (OT) Guide For Prototype Projects” dated January 2001 (as amended) (<http://www.acq.osd.mil/dpap/Docs/otguide.doc>), information must be included in the cost proposal to support the claim. Additionally, if the offeror plans to request an award of an 845 OTA agreement, without the required one-third (1/3) cost share, information must be included in the cost proposal supporting that there is at least one non-traditional defense Contractor participating to a significant extent in the proposed prototype project.

C. Submission Dates and Times

The full proposal must be submitted per the instructions in Section IV.B. - Content and Form of Application Submission by 1200 noon (ET) on **18 June 2009** (initial closing) in order to be considered during the initial evaluation phase. While DARPA-BAA-09-40 will remain open until 1200 noon (ET) **14 April 2010** (final closing date/BAA expiration), offerors are warned that the likelihood of funding is greatly reduced for proposals submitted after the initial closing date.

DARPA will acknowledge receipt of complete submissions via email and assign control numbers that should be used in all further correspondence regarding proposals.

Failure to comply with the submission procedures may result in the submission not being evaluated.

D. Intergovernmental Review - N/A

E. Funding Restrictions

DARPA currently anticipates using 6.1 funding for this program. If DARPA does use 6.1 funding for any effort funded under this BAA, the Contractor is hereby notified that total negotiated indirect cost rates may not exceed 35% of the total cost of the award. Total costs include all bottom line costs. For Grant/Agreement awardees subject to the cost principles in 2 CFR part 220 (Educational Institutions), indirect costs are all costs of a prime award that are Facilities and Administration costs. For Grant/Agreement awardees subject to the cost principles in 2 CFR part 225 (State, Local, and Indian Tribal Governments), 2 CFR part 230 (Non-Profit Organizations) or 48 CFR part 32 (Federal Acquisition Regulation), indirect cost means any cost not directly identified with a single final cost objective, but identified with two or more final cost objectives or with at least one intermediate cost objective. The cost limitations do not flow down to subcontractors.

F. Other Submission Requirements

Proposals **MUST NOT** be submitted to DARPA via fax, email or in hard copy (see Submission instructions in Section IV.B. - Content and Form of Application Submission).

University (prime) cooperative agreement submissions may be made via the Grants.gov web site (<http://www.grants.gov/>) by using the "Apply for Grants" function. Duplicate

submissions should not be uploaded to DARPA via the online tool described above in Section IV.B. however, offerors must still submit an online coversheet as described there.

V. APPLICATION REVIEW INFORMATION

A. Evaluation Criteria

Evaluation of proposals will be accomplished through a scientific review of each proposal using the following criteria. While these criteria are listed in descending order of relative importance, it should be noted that the combination of all non-cost evaluation factors is significantly more important than cost.

1. Ability to Meet Program Go/No-Go Metrics

The feasibility and likelihood of the proposed approach for satisfying the program go/no-go metrics are explicitly described and clearly substantiated. The proposal reflects a mature and quantitative understanding of the performance go/no-go metrics, the statistical confidence with which they may be measured, and their relationship to the concept of operations that will result from successful performance in the program.

2. Overall Scientific and Technical Merit

The proposed technical approach is feasible, achievable, complete and supported by a proposed technical team that has the expertise and experience to accomplish the proposed tasks. Task descriptions and associated technical elements provided are complete and in a logical sequence with all proposed deliverables clearly defined such that a final product that achieves the goal can be expected as a result of award. The proposal identifies major technical risks and planned mitigation efforts are clearly defined and feasible.

3. Offeror's Capabilities and/or Related Experience

The offeror's prior experience in similar efforts must clearly demonstrate an ability to deliver products that meet the proposed technical performance within the proposed budget and schedule. The proposed team has the expertise to manage the cost and schedule. Similar efforts completed/ongoing by the offeror in this area are fully described including identification of other Government sponsors.

4. Potential Contribution and Relevance to the DARPA Mission

The objective of this criterion is to establish a strong link between this work and the DARPA mission. Specifically, DARPA's mission is to maintain the technological superiority of the U.S. military and prevent technological surprise from harming our national security by sponsoring revolutionary, high-payoff research that bridges the gap between fundamental discoveries and their military use. It is NOT necessary that the proposed work be immediately usable in military systems. It is only necessary that this work contribute to technical areas of need by the DOD. The offeror need not focus on military details but may instead clearly address more generally how the proposed effort will advance the DARPA goals of superior and revolutionary insight into the potential

contributions of the proposed effort with relevance to the national technology base. Since one goal of the Deep Learning program is the advancement of the field of computer science to maintain U.S. technological superiority, proposals should maximize the availability of deep learning technologies and data for public reuse to further work in this field. One subfactor for evaluation within this criterion consists of an assessment of the extent to which the intellectual property stipulations of the proposal are consistent with the scientific advancement goals of the program and DARPA.

5. Realism of Proposed Schedule

Development Team Proposals

The offeror's abilities to aggressively pursue performance metrics in the shortest timeframe and to accurately account for that timeframe will be evaluated, as well as offeror's ability to understand, identify, and mitigate any potential risk in schedule.

Evaluation Team Proposals

The offeror's abilities to deliver quality datasets, task specifications, and evaluation protocols within the program's timeframes and to accurately account for that timeframe will be evaluated, as well as offeror's ability to understand, identify, and mitigate any potential risk in schedule.

6. Cost Realism

The objective of this criterion is to establish that the proposed costs are realistic for the technical and management approach offered, as well as to determine the offeror's practical understanding of the effort. This will be principally measured by cost per labor-hour and number of labor-hours proposed. The evaluation criterion recognize that undue emphasis on cost may motivate offerors to offer low-risk ideas with minimum uncertainty and to staff the effort with junior personnel in order to be in a more competitive posture. DARPA discourages such cost strategies. Cost reduction approaches that will be received favorably include innovative management concepts that maximize direct funding for technology and limit diversion of funds into overhead.

NOTE: OFFERORS ARE CAUTIONED THAT EVALUATION RATINGS MAY BE LOWERED AND/OR PROPOSALS REJECTED IF SUBMITTAL INSTRUCTIONS ARE NOT FOLLOWED.

B. Review and Selection Process

It is the policy of DARPA to ensure impartial, equitable, comprehensive proposal evaluations and to select the source (or sources) whose offer meets the Government's technical, policy, and programmatic goals. Pursuant to FAR 35.016, the primary basis for selecting proposals for acceptance shall be technical, importance to agency programs, and fund availability. In order to provide the desired evaluation, qualified Government personnel will conduct reviews and (if necessary) convene panels of experts in the appropriate areas.

Each proposal will be evaluated on the merit and relevance of the specific proposal as it relates to the office rather than against other proposals for research in the same general

area, since no common work statement exists. DARPA's intent is to review proposals as soon as possible after they arrive; however, proposals may be reviewed periodically for administrative reasons. For evaluation purposes, a proposal is the document described above in Section IV.B. – Content and Form of Application Submission. Other supporting or background materials submitted with the proposal will be considered for the reviewer's convenience only and not considered as part of the proposal.

Award(s) will be made to offerors whose proposals are determined to be the most advantageous to the Government, all factors considered, including the potential contributions of the proposed work to the overall research program and the availability of funding for the effort. Award(s) may be made to any offeror whose proposal is determined selectable regardless of its overall rating.

Restrictive notices notwithstanding, offerors are advised that employees of commercial firms under contract to the Government may be used by DARPA to administratively process proposals, monitor contract performance, or perform other administrative duties requiring access to other contractors' proprietary information. These support contracts include nondisclosure agreements prohibiting their contractor employees from disclosing any information submitted by other contractors or using such information for any purpose other than that for which it was furnished. By submission of its proposal, each offeror agrees that proposal information may be disclosed to those non-Government personnel for the limited purposes stated above. In addition, these support contractors are prohibited from competition in DARPA technical research. Subject to the restrictions set forth in FAR 37.203(d), input on technical aspects of the proposals may be solicited by DARPA from non-Government consultants /experts who are strictly bound by the appropriate non-disclosure requirements.

It is the policy of DARPA to treat all proposals as competitive information and to disclose their contents only for the purpose of evaluation. No proposals will be returned. Upon completion of the source selection process, the original of each proposal received will be retained at DARPA and all other copies will be destroyed.

VI. AWARD ADMINISTRATION INFORMATION

A. Award Notices

As soon as the evaluation of a proposal is complete, the offeror will be notified that 1) the proposal has been selected for funding pending contract negotiations, or, 2) the proposal has not been selected. These official notifications will be sent via US mail to the Technical POC identified on the proposal coversheet.

B. Administrative and National Policy Requirements

1. Security Classification and Proprietary Issues

NOTE: If proposals are classified, the proposals must indicate the classification level of not only the proposal itself, but also the anticipated award document classification level.

The Government anticipates proposals submitted under this BAA will be unclassified. However, if a proposal is submitted as "Classified National Security Information" as defined by Executive Order 12958 as amended, then the information must be marked and protected as though classified at the appropriate classification level and then submitted to DARPA for a final classification determination.

Offerors choosing to submit a classified proposal from other classified sources must first receive permission from the respective Original Classification Authority in order to use their information in replying to this BAA. Applicable classification guide(s) should also be submitted to ensure the proposal is protected at the appropriate classification level.

Submissions requiring DARPA to make a final classification determination shall be marked as follows: "CLASSIFICATION DETERMINATION PENDING. Protect as though classified (insert the recommended classification level: (e.g., Top Secret, Secret or Confidential))"

Classified submissions shall be appropriately and conspicuously marked with the proposed classification level and declassification date. In addition, classified submissions shall be in accordance with the following guidance:

Confidential and Secret Collateral Information: Use classification and marking guidance provided by previously issued security classification guides, the Information Security Regulation (DoD 5200.1-R), and the National Industrial Security Program Operating Manual (DoD 5220.22-M) when marking and transmitting information previously classified by another Original Classification Authority. Classified information at the Confidential and Secret level may be mailed via appropriate U.S. Postal Service methods (e.g., USPS Registered Mail or USPS Express Mail). All classified information will be enclosed in opaque inner and outer covers and double wrapped. The inner envelope shall be sealed and plainly marked with the assigned classification and addresses of both sender and addressee. The inner envelope shall be address to:

Defense Advanced Research Projects Agency
ATTN: IPTO
Reference: DARPA-BAA-09-40
3701 North Fairfax Drive
Arlington, VA 22203-1714

The outer envelope shall be sealed with no identification as to the classification of its contents and addressed to:

Defense Advanced Research Projects Agency
Security & Intelligence Directorate, Attn: CDR
3701 North Fairfax Drive
Arlington, VA 22203-1714

All Top Secret materials: Top Secret information should be hand carried by an appropriately cleared and authorized courier to the DARPA CDR. Prior to traveling, the courier shall contact the DARPA CDR at 571 218-4842 to coordinate arrival and delivery.

Special Access Program (SAP) Information: SAP information must be transmitted via approved methods. Prior to transmitting SAP information, contact the DARPA SAPCO at 703-526-4052 for instructions.

Sensitive Compartmented Information (SCI): SCI must be transmitted via approved methods. Prior to transmitting SCI, contact the DARPA Special Security Office (SSO) at 703-248-7213 for instructions.

Proprietary Data: All proposals containing proprietary data should have the cover page and each page containing proprietary data clearly marked as containing proprietary data. It is the Offeror's responsibility to clearly define to the Government what is considered proprietary data.

Security classification guidance via a DD Form 254 will not be provided at this time since DARPA is soliciting ideas only. After reviewing the incoming proposals, if a determination is made that the award instrument may result in access to classified information a DD Form 254 will be issued and attached as part of the award.

Offerors must have existing and in-place prior to execution of an award, approved capabilities (personnel and facilities) to perform research and development at the classification level they propose. It is the policy of DARPA to treat all proposals as competitive information, and to disclose their contents only for the purpose of evaluation. Proposals will not be returned. The original of each proposal received will be retained at DARPA and all other non-required copies destroyed.

2. Intellectual Property

All software/firmware, software/firmware documentation, source code, test data and technical data developed with government or mixed funding under the Deep Learning Program will be provided to the government with a minimum of Government Purpose Rights, consistent with Defense Federal Acquisition Regulation Supplement (DFARS) 252.227-7013 and -7014. To the greatest extent feasible, offerors should not include background proprietary software and data as the basis of their proposed approach; offerors wishing to use proprietary software and data as the basis of their proposed approach should also recommend an amelioration strategy (replacing proprietary components with open source alternatives, research versions, etc.) to address, among other things, possible public releases. Offerors expecting to utilize, but not to deliver,

open source tools or other materials in implementing their approach must ensure that the government does not incur any legal obligation due to such utilization.

a. Procurement Contract Offerors

i. Noncommercial Items (Technical Data and Computer Software)

Offerors responding to this BAA requesting a procurement contract to be issued under the FAR/DFARS shall identify all noncommercial technical data and noncommercial computer software that it plans to generate, develop, and/or deliver under any proposed award instrument in which the Government will acquire less than unlimited rights, and to assert specific restrictions on those deliverables. Offerors shall follow the format under DFARS 252.227-7017 for this stated purpose. In the event that offerors do not submit the list, the Government will assume that it automatically has “unlimited rights” to all noncommercial technical data and noncommercial computer software generated, developed, and/or delivered under any award instrument, unless it is substantiated that development of the noncommercial technical data and noncommercial computer software occurred with mixed funding. If mixed funding is anticipated in the development of noncommercial technical data and noncommercial computer software generated, developed, and/or delivered under any award instrument, then offerors should identify the data and software in question, as subject to Government Purpose Rights (GPR). In accordance with DFARS 252.227-7013 Rights in Technical Data - Noncommercial Items, and DFARS 252.227-7014 Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation, the Government will automatically assume that any such GPR restriction is limited to a period of five (5) years in accordance with the applicable DFARS clauses, at which time the Government will acquire “unlimited rights” unless the parties agree otherwise. Offerors are admonished that the Government will use the list during the source selection evaluation process to evaluate the impact of any identified restrictions and may request additional information from the offeror, as may be necessary, to evaluate the offeror’s assertions. If no restrictions are intended, then the offeror should state “NONE.”

A sample list for complying with this request is as follows:

NONCOMMERCIAL			
Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(LIST)	(LIST)	(LIST)	(LIST)

ii. Commercial Items (Technical Data and Computer Software)

Offerors responding to this BAA requesting a procurement contract to be issued under the FAR/DFARS shall identify all commercial technical data and commercial computer software (including open source software) that may be embedded in, or that may create linkages affecting distribution rights to, any noncommercial deliverables contemplated

under the research effort, along with any applicable restrictions on the Government’s use of such commercial technical data and/or commercial computer software. In the event that offerors do not submit the list, the Government will assume that there are no restrictions on the Government’s use of such commercial items. The Government may use the list during the source selection evaluation process to evaluate the impact of any identified restrictions and may request additional information from the offeror, as may be necessary, to evaluate the offeror’s assertions. If no restrictions are intended, then the offeror should state “NONE.”

A sample list for complying with this request is as follows:

COMMERCIAL			
Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(LIST)	(LIST)	(LIST)	(LIST)

b. Non-Procurement Contract Offerors – Noncommercial and Commercial Items (Technical Data and Computer Software)

Offerors responding to this BAA requesting an Other Transaction or Cooperative Agreement shall follow the applicable rules and regulations governing these various award instruments, but in all cases should appropriately identify any potential restrictions on the Government’s use of any Intellectual Property contemplated under those award instruments in question. This includes both Noncommercial Items and Commercial Items. Although not required, offerors may use a format similar to that described above. The Government may use the list during the source selection evaluation process to evaluate the impact of any identified restrictions, and may request additional information from the offeror, as may be necessary, to evaluate the offeror’s assertions. If no restrictions are intended, then the offeror should state “NONE.”

c. All Offerors – Patents

Include documentation proving your ownership of or possession of appropriate licensing rights to all patented inventions (or inventions for which a patent application has been filed) that will be utilized under your proposal for the DARPA program. If a patent application has been filed for an invention that your proposal utilizes, but the application has not yet been made publicly available and contains proprietary information, you may provide only the patent number, inventor name(s), assignee names (if any), filing date, filing date of any related provisional application, and a summary of the patent title, together with either: 1) a representation that you own the invention, or 2) proof of possession of appropriate licensing rights in the invention.

d. All Offerors – Intellectual Property Representations

Provide a good faith representation that you either own or possess appropriate licensing rights to all other intellectual property that will be utilized under your proposal for the DARPA program. Additionally, offerors shall provide a short summary for each item

asserted with less than unlimited rights that describes the nature of the restriction and the intended use of the intellectual property in the conduct of the proposed research.

3. Meeting and Travel Requirements

There will be a program kickoff meeting and all key participants are required to attend. Principal investigators will be required to attend mid-phase and inter-phase meetings and a program wrap meeting at continental U.S. locations. Performers should also anticipate periodic site visits at the DARPA program manager's discretion.

4. Human Use

All research involving human subjects, to include use of human biological specimens and human data, selected for funding must comply with the federal regulations for human subject protection. Further, research involving human subjects that is conducted or supported by the DoD must comply with 32 CFR 219, *Protection of Human Subjects* (<http://www.dtic.mil/biosys/downloads/32cfr219.pdf>), and DoD Directive 3216.02, *Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research* (<http://www.dtic.mil/whs/directives/corres/html2/d32162x.htm>).

Institutions awarded funding for research involving human subjects must provide documentation of a current Assurance of Compliance with Federal regulations for human subject protection, for example a Department of Health and Human Services, Office of Human Research Protection Federal Wide Assurance (<http://www.hhs.gov/ohrp>). All institutions engaged in human subject research, to include subcontractors, must also have a valid Assurance. In addition, personnel involved in human subjects research must provide documentation of completing appropriate training for the protection of human subjects.

For all proposed research that will involve human subjects in the first year or phase of the project, the institution must provide evidence of or a plan for review by an Institutional Review Board (IRB) upon final proposal submission to DARPA. The IRB conducting the review must be the IRB identified on the institution's Assurance. The protocol, separate from the proposal, must include a detailed description of the research plan, study population, risks and benefits of study participation, recruitment and consent process, data collection, and data analysis. Consult the designated IRB for guidance on writing the protocol. The informed consent document must comply with federal regulations (32 CFR 219.116). A valid Assurance, along with evidence of appropriate training for all investigators, should accompany the protocol for review by the IRB.

In addition to a local IRB approval, a headquarters-level human subjects regulatory review and approval is required for all research conducted or supported by the DoD. The Army, Navy, or Air Force office responsible for managing the award can provide guidance and information about their component's headquarters-level review process. Note that confirmation of a current Assurance and appropriate human subjects protection training is required before headquarters-level approval can be issued.

The amount of time required to complete the IRB review/approval process may vary depending on the complexity of the research and/or the level of risk to study participants. Ample time should be allotted to complete the approval process. The IRB approval process can last for one to three months, followed by a DoD review that can last for three to six months. No DoD/DARPA funding can be used toward human subjects research until ALL approvals are granted.

5. Animal Use

Any Recipient performing research, experimentation, or testing involving the use of animals shall comply with the rules on animal acquisition, transport, care, handling, and use in: (i) 9 CFR parts 1-4, Department of Agriculture rules that implement the Laboratory Animal Welfare Act of 1966, as amended, (7 U.S.C. 2131-2159); (ii) the guidelines described in National Institutes of Health Publication No. 86-23, "Guide for the Care and Use of Laboratory Animals"; (iii) DoD Directive 3216.01, "Use of Laboratory Animals in DoD Program."

For submissions containing animal use, proposals should briefly describe plans for Institutional Animal Care and Use Committee (IACUC) review and approval. Animal studies in the program will be expected to comply with the PHS Policy on Humane Care and Use of Laboratory Animals, available at <http://grants.nih.gov/grants/olaw/olaw.htm>.

All Recipients must receive approval by a DoD certified veterinarian, in addition to an IACUC approval. No animal studies may be conducted using DoD/DARPA funding until the USAMRMC Animal Care and Use Review Office (ACURO) or other appropriate DoD veterinary office(s) grant approval. As a part of this secondary review process, the Recipient will be required to complete and submit an ACURO Animal Use Appendix, which may be found at <https://mrmc.amedd.army.mil/AnimalAppendix.asp>

6. Publication Approval

It is the policy of the Department of Defense for products of fundamental research to remain unrestricted to the maximum extent possible. Contracted fundamental research includes research performed under grants and contracts that are (a) Basic Research, whether performed by universities or industry or (b) applied research and performed on-campus at a university. The research shall not be considered fundamental in those rare and exception circumstances where the applied research effort presents a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense, and where agreement on restrictions have been recorded in the contract or grant.

It is anticipated that the performance of research resulting from the BAA is expected to be fundamental research.

Offerors are advised if they propose cooperative agreements, DARPA may elect to award other award instruments. DARPA will make this election if it determines that the research resulting from the proposed program will present a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are

unique and critical to defense. Any award resulting from such a determination will include a requirement for DARPA permission before publishing any information or results on the program.

The following provision will be incorporated into any resultant non-fundamental research procurement contract or other transaction:

There shall be no dissemination or publication, except within and between the Contractor and any subcontractors, of information developed under this contract or contained in the reports to be furnished pursuant to this contract without prior written approval of the DARPA Technical Information Officer (DARPA/TIO). All technical reports will be given proper review by appropriate authority to determine which Distribution Statement is to be applied prior to the initial distribution of these reports by the Contractor. Papers resulting from unclassified contracted fundamental research are exempt from prepublication controls and this review requirement, pursuant to DoD Instruction 5230.27 dated October 6, 1987.

When submitting material for written approval for open publication, the Contractor/Awardee must submit a request for public release to the DARPA TIO and include the following information: 1) Document Information: document title, document author, short plain-language description of technology discussed in the material (approx. 30 words), number of pages (or minutes of video) and document type (briefing, report, abstract, article, or paper); 2) Event Information: event type (conference, principle investigator meeting, article or paper), event date, desired date for DARPA's approval; 3) DARPA Sponsor: DARPA Program Manager, DARPA office, and contract number; and 4) Contractor/Awardee's Information: POC name, e-mail and phone. Allow four weeks for processing; due dates under four weeks require a justification. Unusual electronic file formats may require additional processing time. Requests can be sent either via e-mail to tio@darpa.mil or via 3701 North Fairfax Drive, Arlington VA 22203-1714, telephone (571) 218-4235. Refer to www.darpa.mil/tio for information about DARPA's public release process.

7. Export Control

Should this project develop beyond fundamental research (basic and applied research ordinarily published and shared broadly within the scientific community) with military or dual-use applications the following apply:

- The Contractor shall comply with all U. S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, in the performance of the contract or agreement. In the absence of available license exemptions/exceptions, the Contractor shall be responsible for obtaining the appropriate licenses or other approvals, if required, for exports

(including deemed exports) of hardware, technical data, and software, or for the provision of technical assistance.

- The Contractor shall be responsible for obtaining export licenses, if required, before utilizing foreign persons in the performance of this contract, including instances where the work is to be performed on-site at any Government installation (whether in or outside the United States), where the foreign person will have access to export-controlled technologies, including data or software.
- The Contractor shall be responsible for all regulatory record keeping requirements associated with the use of licenses and license exemptions/exceptions.
- The Contractor shall be responsible for ensuring that the provisions of this clause apply to its subcontractors.

8. Subcontracting

Pursuant to Section 8(d) of the Small Business Act (15 U.S.C. 637(d)), it is the policy of the Government to enable small business and small disadvantaged business concerns to be considered fairly as subcontractors to contractors performing work or rendering services as prime contractors or subcontractors under Government contracts, and to assure that prime contractors and subcontractors carry out this policy. Each offeror who submits a contract proposal and includes subcontractors is required to submit a subcontracting plan in accordance with FAR 19.702(a) (1) and (2) should do so with their proposal. The plan format is outlined in FAR 19.704.

9. Central Contractor Registration (CCR)

Offerors selected, but not already registered in the Central Contractor Registry (CCR) will be required to register in CCR prior to any award under this BAA. Information on CCR registration is available at <http://www.ccr.gov>

10. On-line Representations and Certifications (ORCA)

In accordance with FAR 4.1201, prospective offerors shall complete electronic annual representations and certifications at <http://orca.bpn.gov>.

11. Wide Area Work Flow (WAWF)

Unless using another approved electronic invoicing system, performers will be required to submit invoices for payment directly via the Internet/WAWF at <http://wawf.eb.mil>. Registration to WAWF will be required prior to any award under this BAA.

12. Electronic and Information Technology

All electronic and information technology acquired through this solicitation must satisfy the accessibility requirements of Section 508 of the Rehabilitation Act (29 U.S.C. 794d) and FAR Subpart 39.2. Each proposer who submits a proposal involving the creation or inclusion of electronic and information technology must ensure that Federal employees with disabilities will have access to and use of information that is comparable to the access and use by Federal employees who are not individuals with disabilities and members of the public with disabilities seeking information or services from DARPA will have access to and use of information and data that is comparable to the access and

use of information and data by members of the public who are not individuals with disabilities.

C. Reporting

1. T-FIMS

The award document for each proposal selected and funded will contain a mandatory requirement for four DARPA/IPTO Quarterly Status Reports each year (one of which will be an annual project summary), and a final project report that summarizes the entire project, notwithstanding the fact that the research may be continued under a follow-on vehicle. These reports may be electronically submitted by each awardee under this BAA via the DARPA Technical – Financial Information Management System (T-FIMS). These reports may be electronically submitted by each awardee under this BAA via the DARPA Technical – Financial Information Management System (T-FIMS). The T-FIMS URL and instructions will be furnished by the contracting agent upon award. There may also be additional reporting requirements for cooperative agreements and Other Transactions. In addition, each performing contractor (including subs) on each team will be expected to provide monthly status reports to the Program Manager. Reports and briefing material will also be required as appropriate to document progress in accomplishing program metrics.

2. I-Edison

All required reporting shall be accomplished, as applicable, using the i-Edison.gov reporting website at <http://s-edison.info.nih.gov/iEdison>

VII. AGENCY CONTACTS

DARPA will use electronic mail for all technical and administrative correspondence regarding this BAA, with the exception of selected/not-selected notifications.

Administrative, technical or contractual questions should be sent via e-mail to DARPA-BAA-09-40@darpa.mil. If e-mail is not available, please fax questions to 703-516-8851, Attention: Deep Learning Solicitation. All requests must include the name, email address, and phone number of a point of contact.

Solicitation Web site: <http://www.darpa.mil/ipto/solicit/solicit.asp>.

VIII. OTHER INFORMATION

The solicitation web page at www.darpa.mil/ipto/solicit/solicit.asp will have a Frequently Asked Questions (FAQ) list.

A. Collaborative Efforts/Teaming

Collaborative efforts/teaming are encouraged. A website (<http://csc-ballston.dmeid.org/baa/DLteaming.htm>) has been established to facilitate formation of teaming arrangements between interested parties. Specific content,

communications, networking, and team formation are the sole responsibility of the participants. Neither DARPA nor the Department of Defense (DoD) endorses the destination web site or the information and organizations contained therein, nor does DARPA or the DoD exercise any responsibility at the destination. This website is provided consistent with the stated purpose of this BAA.

B. Industry Day

An industry day is planned in conjunction with this BAA. It is scheduled for 07 May 2009 in Arlington, Virginia. Additional details may be found at www.schafertmd.com/conference/deeplearning2009. Interested parties must be registered on this site no later than 28 April 2009.

C. Examples of Test Datasets and Tasks

The following table lists existing datasets that represent the variety of data that may be chosen for use in the Deep Learning program, together with examples of tasks. DARPA may or may not choose to use the datasets and tasks listed in this table. Evaluation Team offerors may choose to propose datasets from this list, other existing datasets, the enhancement of existing datasets, or the creation of entirely new datasets. The examples given are not intended to lead offerors to specify these datasets, or to suggest that the tasks listed will be assigned in the program.

Example Dataset	Description	Example Tasks
NIST Special Database 19	Hand-printed sample forms from 3,600 writers, 810,000 character images isolated from their forms, ground truth classifications for those images, and software utilities for image management and handling	Character recognition
Caltech-256	Over 30,000 images with objects from 256 categories plus clutter, with at least 80 images per category	Object detection and recognition; scene characterization
i-LIDS MCTS	140 hours of surveillance video with overlapping and non-overlapping views from five cameras; 185,000 annotated frames	Detection and classification of people and objects; activity detection and recognition; path finding; intent determination
TREC GOV2	Over 25 million text documents collected from a web crawl of the .gov domain; 92% HTML, 8% PDF and other text.	Syntactic and semantic labeling; named entity recognition and relations
University of Wisconsin SensIT	Acoustic and seismic recordings of vehicles with event timeseries and feature files; about 3 GB	Detection and classification of objects and activities; intent determination
LDC TIMIT	Broadband recordings of 630	Word identification; syntactic

	speakers of eight major American English dialects reading ten phonetically rich sentences; includes orthographic, phonetic, and word transcriptions in addition to the digitized recordings	labeling
Wright State 100	Overhead LIDAR data and ground truth	Object detection, classification, and characterization
NIST Meeting Room Pilot Corpus	Audio/video recordings of meetings using multiple microphones and cameras, transcriptions and annotations	Detection and classification of people, objects, and activities; speech recognition; named entity extraction; scene characterization; sentiment extraction, transcription

Table 2 – Example Test Datasets and Tasks