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Teleprompter Script for Dr. Charlie Holland, Director, Information Processing Technology Office

The Way Forward

» CHARLIE HOLLAND:
You have just heard some of the ways IPTO is developing information understanding technologies to achieve decision dominance.

"Extreme computing" will create revolutionary high-productivity computer and software technology.

Cognitive learning and reasoning systems will give computers comprehensive understanding of situations and data.

Language processing technologies will enable automatic translation of foreign speech and text.

And advances in computational social science will revolutionize our ability to assess trouble spots.

I want to close by briefly describing some
(and only some) of our other new and visionary ideas that are just getting underway.

Finally,
I'll ask for your help.

Planning an engagement with the enemy involves a huge amount of uncertainty and complexity.

The commander has to “look into the future” and assess multiple possible situations.

Depending on what the enemy does,

many more situations become possible.

When things don’t go as expected, the commander has to scramble to understand the ramifications of the new situation and make a decision.

And, in active warfare, these decisions have to be made quickly –

very quickly!

Colonel John “Buck” Surdu’s Deep Green program will develop a computer-based simulation and decision support system for the commander.

By using new qualitative simulation methods,

it will generate option and solution spaces much more quickly than ever before.

It will generate plausibility ratings, or likelihoods,

to focus the commander and staff on generating options where they are needed –

before they are needed.

And, it will allow the commander to plan,

re-plan, and communicate with the same method used today:

rough sketching augmented with speech.

This last piece is hard!

First the machine must recognize and translate the squiggles in the input into standard military symbols.

Then it must capture the substance of the commanders intended plan and fill in the missing pieces.

Sounds like Joe Olive’s translators a little bit?

In those terms,

it translates the language of sketching to a machine-understandable plan.

This technology will lead to fundamentally new ways of human-computer interaction.

Buck’s BAA is announced, and I encourage you to talk to him

Software developers on big projects often use existing software tools and frameworks.

These frameworks provide structure and support and can be extremely useful in writing complex applications.

But this structure comes at a cost, because the frameworks themselves are very complex.

Developers are often in a learning mode, "exploring" their software frameworks as they build systems.

And, if a developer has to migrate to a new framework or tool,

they have problems.

The abstractions may be different;

the packaged software architectures may be different,

key operational concepts may be different;

and a plethora of detail about method names and parameter meanings

may be different.

This results in labor intensive designs, sometimes saddled with flaws that could have been avoided, and sometimes redundant, buggy algorithms.

Lee Badger from our office is considering new ideas for developing

inter-framework mappings and other techniques to make software expertise more portable to the next required framework.

Developing tools and principles to shorten the "amateur phase"

during framework uptake will revolutionize the productivity of software designers/developers and result in more rapid fielding of higher quality military systems.

Talk to Lee if these ideas interest you.

Typically, in today's robotic systems *programmers* specify what it is that the system will reason over and *programmers* specify what terms and variables mean to the system.

For instance,

in a cognitive system a programmer may give the system a model of an object, like a tank,

and tell the system about what to do when it sees a tank....

like, shoot, run, hide, etc.

The tank model, and how to respond to it, are both hard-coded by the human.

This is inherently limiting and leads to systems that are brittle and cannot acquire new concepts of the world without human intervention.

Tom Wagner is considering how robots could build their own models of the world and objects in it -- and to do this without human input.

Imagine a robot being given a dozen similar-sized objects and having it learn on its own which objects are members of the same set,

such as can, ball, cup.

Allowing systems to learn and manipulate their own models and concepts will remove a fundamental barrier to robust machine intelligence.

This is a key enabling technology that will facilitate the creation of platforms that can adapt effectively to complex unstructured environments.

Tom is available to discuss these ideas.

An intelligent assistant that helps the commander fight the battle with speed and flexibility, reducing the ability of the enemy to surprise us.

Technologies that leverage the knowledge a programmer already knows, so that new software tool sets can be used to quickly build new applications.

Robots that explore and learn the structure of the world, on their own, without massive programming.

These are some of exciting ideas we are beginning to explore.

But we need your help.

The uncertainty and complexity of the world

is growing.

We are making great progress in taming the data wilderness, but there is so much more to do.

If we can continue to develop and apply revolutionary information technologies,

we can achieve information understanding and decision dominance and beat our enemies to the punch.

Thank you.