Thinking model and machine understanding of English primitive texts and it's application in Infrastructure as Service domain.

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Abstract—**Construction of machine understanding is definitely the challenge. There are several technologies used widely. Currently mainstream applications uses machine operatable knowledge bases, for example Wolfram Alpha[?] to support simple dialogue and operate devices. Newer the less those approaches do not create machine understanding of even primitive incidents. We tried new approach based on assumption that human understanding is tightly coupled with human thinking itself. We used thinking model described in Marvin Minsky book "The emotion machine"[?].**

I. THE EMOTION MACHINE THINKING MODEL

A. 6 thinking levels

Marvin Minsky introduces the thinking as layered model that contains 6 layers:
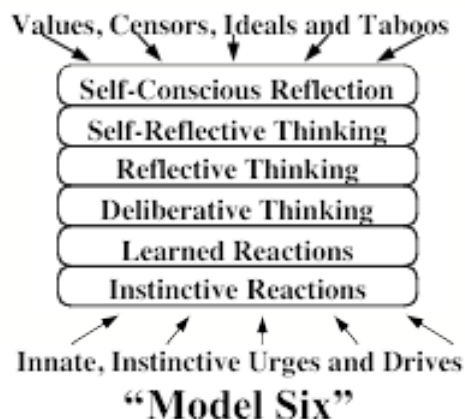
* *Instinctive Reactions*: Joan hears a sound and turns her head. All animals are born equipped with "instincts" that help them to survive.

* *Learned Reactions*: She sees a quickly oncoming car. Joan had to learn that conditions like this demand specific ways to react.

* *Deliberative Thinking*: To decide what to say at the meeting, she considers several alternatives, and tries to decide which would be best.

* *Reflective Thinking*: Joan reflects upon what she has done. She reacts, not just to things in things in the world, but also to recent events in her brain.

* *Self-Reflective Thinking*: Being "uneasy about arriving late" requires her to keep track of the plans that she's made for herself.

* *Self-Conscious Thinking*: When asking what her friends think of her, she also asks how her actions concord with ideals she has set for herself.

Each upper layer controls lower layers, and is based on constructs and uses signals of lower layers as input. In other words the top level *Self-Conscious Thinking* controls *Self-Reflective Thinking*, *Reflective*, e.t.c. In our implementation currently we do not use *Instinctive Reactions*, but using of it is planned for future.

B. Selector, Critic, Way to think triple
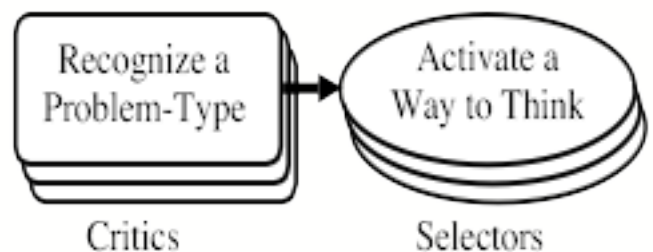
Marvin Minsky defines Critics - Selector behavior as following:
On the left are resources that we shall call Critics, each of which can recognize a certain species of "Problem-Type". When a Critic sees enough evidence that you now are facing its type of problem, then that Critic will try to activate a "Way to Think" that may be useful in current situation.

Critic -¿ Selector -¿ Way to think are main components that implements all the machine understanding process. Critics could be understood as probabilistic predicates that does analysis of current context in memory. Selector retrieves resources from memory. Way to think is main worker that updates current context in memory.

identify a type of obstacle   switch to a suitable way to think

Cloud of Resources
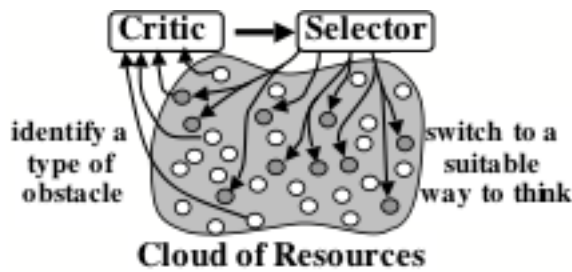
II. IMPLEMENTATION OF THINKING MODEL

Liu H. and Lieberman H.[**?**] described approach to generate Python classes from shallow English descriptions, like: *James Bond is an agent* which was our inspiration.

We have implemented thinking model described above over the IT DID[1]. Main unit of information to be processed is incident: the issue with description.

A. Thinking levels control

6 thinking levels are implemented by ThinkingLifeCycle component. It starts and controls and implements collaboration of actions: critics or ways to think that are assigned to different thinking layers. ThinkingLifeCycle also controls context of current incident processing in short term memory. It also controls goals orientation: to make whole machine understanding process oriented to the main goal: help user.

- Critics are implemented as functions that returns selector request with probability and confidence.

- Selector runs requests and retrieves resources from memory(first from short term then from long term).

- Way to think are implemented as components that actually changes the contents of short term memory.

B. Memory

Memory is something that are associated with structures and objects in computer memory and stored in Knowledge Base(KB) information. There are two types of memory: Short term and Long term.

C. Short term memory

Short term memory stores the current context of incident processing in "quick" memory. Eventually all objects from Short term memory should be transformed and stored in Long term memory. This is done via confirmation process and then machine learning (training). Training is based mainly on three mechanisms:

- Deduction(Reasoning from generalised rules to specific)

- Induction(Generalisation)

- Abduction

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[1]IT DID - IT Dynamic Infrastructure Domain - domain of IT services like remote Infrastructure support

D. Long term memory

Long term memory stores persistent information mainly in the KB, this information has following structures:

- Narrative - some kind of container of sequence of concepts

- Semantic network (mainly: Semantic network of concepts) - graf, that connect concepts using the semantic links.

- Knowledge line - list of references, that addresses concepts in different domains.

III. OUR RESEARCH GOALS

- Develop simulation and extend into practical approach a theory of the cognitive skills that IT specialists need to function effectively in fast-paced IT DID domain. It is a major requisite in way of establishing a virtual IT engineer.

- Develop methods for training KB those skills in the context of Dynamic Infrastructure Support incident decision solving. Create simulation with ability to grasp the essential elements of a routine, complex, uncertain, and dynamic situation in terms of IT services incident resolution goals, and take action in a timely and decisive manner.

- Test the effectiveness of the KB IT domain training. Does the training improve critical thinking IT system skills? Does it improve the quality of the a system early prototype decisions?

- Develop a system stable architecture to support adaptive work instruction and feedback in critical thinking and its KB domain training. The architecture should be able to simulate both rapid responses to familiar situations and more reflective responses to debatable assertion and uncertain situations.

IV. IT DID APPLICATION OF THE THINKING MODEL

According to our analysis [2] IT DID contains at least 60% of incidents: issues that are mainly simple or primitive issues related to connectivity or software problems on a customer machine. Goal is to automate such kind of incidents

IT Infrastructure maintenance domain is a labour intensive process and contains many tools that help to solve a lot of every-day problems to support business operations. IT Infrastructure maintenance domain has a lot of primitive incidents that seems to be easy to automate. However there is still the gap to run business, operating support is provided by human specialists understanding and making decision how to implement even primitive incidents. One of the key factors in automation and in entire process is to understand input request.

A. Critics and ways to think for incident processing

Using the Critics and Ways to think for incident processing system understands the incidents description. All mechanisms described above introduces base of the thinking model. Simplified incident understanding process(only three layers) is described below.

B. Preliminary processing

First of all, on the Learned layer: textual description is translated in to the form Semantic network this structure is stored in Short term memory:

- Preliminary splitting - processing of sentences and words. Check semantic and spelling of the inbound incident description using the external tools like Google, After The Deadline [3].

- Knowledge base annotation - annotates inbound textual incident description using concepts and phrases previously trained Knowledge Base.

- Lexical parsing - natural language processing framework Relex creates Semantic network of an inbound text[4]

Goal manager selects next goal: Classify incident.

C. Incident classification

Three critics are invoked on the Learned layer:

- Direct instruction analyser - detects direct instructions such us "Please install Firefox"

- Problem description without desired state analyser - detects problem like "I have problem with Office 2010"

- Problem description with desired state analyser - detects problem like "I have Office 2007 installed, but Office 2010 required"

All those critics returns probability of each case (selector request) that are processed by Get most probable action analyser. Most probable selector request is been processed immediately all the rest are stored in short term memory. Then goal manager selects next goal: generate the solution.

D. Direct instruction processing

Solution search mechanism searches for the solution based on direct instruction semantic network, fist in short term memory then in long term memory.

E. Problem description processing

Problem description should be reformulated in form:

- What's wrong

- Problem source

- Problem location references

Then solution search mechanism is started and returns solution with probability of match. If no proper solution found system rises Cry for help(way to think) and reports to human operator. Cry for help opens dialogue with human specialist to acquire missing information or clarify uncertain results.

V. Conclusion

This project represents an unusually high degree of success both in terms of original research, successful practical application, and commercial potential. The project introduces, develops in detail, and tests a variety of methods for improving Critics and Ways to think and decision - validation acceptance skills on non human level.

The project addresses immediate IT business needs for effective and economical methods for typical part of IT engineers daily tasks -operations (based on IT service catalog) to system for its farther automatic incident/problem resolution and execution

According to initial testing on the large amount of incidents - system can understand approximately 61-65% of incidents. However, during the initial processing we highlight some bottle necks and ideas for further optimizations and improvements. So, this percent will be improved.

The underlying thinking model with problem decision and resolution funding technology has even wider potential, for web-based cloud layer intelligent information business insight its retrieval and evaluation

References

[1] Minsky M.: The Emotion Machine. Simon & Schuster Paperbacks (2006).

[2] Liu H., Lieberman H.: Metafor: Visualizing Stories as Code. Cambridge, MIT Media Laboratory (2005).

[3] Russel S., Norvig P.: Artificial Intelligence. A Modern approach. Pearson (2010).

[4] http://www.wolframalpha.com.

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[3] See Seehttp://afterthedeadline.com/formoreinformation

[4] We use RelEx, See http://wiki.opencog.org/w/RelEx_Dependency_Relationship_Extractor