Human Level Artificial Intelligence 2016: Artificial General Intelligence and then some (Part 2)

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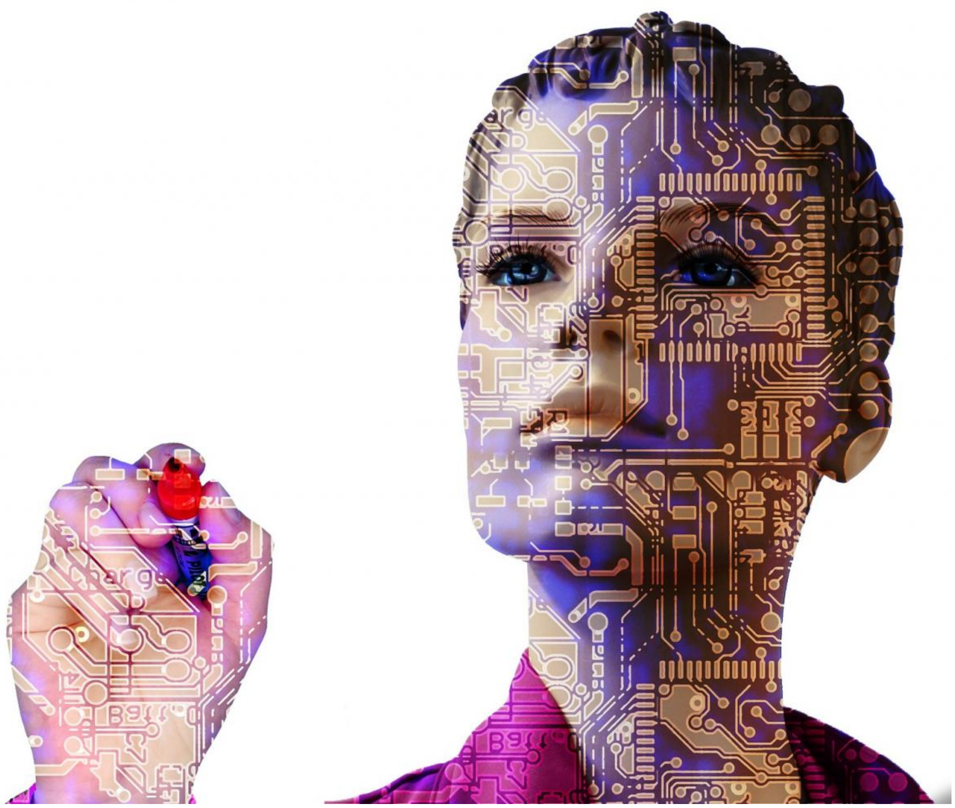

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(Tech Xplore)—In its inception, the field of Artificial Intelligence (AI) sought to create computers with *general intelligence* analogous to our own. This proved to be too challenging and elusive, thereby leading AI research to focus more narrowly on the development of intelligent systems capable of performing only problem- and domain-specific tasks, thereby giving rise to *narrow*, or *weak*, Artificial Intelligence. That said, interest in creating systems possessing human-like (and potentially beyond) general, or *strong*, Artificial Intelligence has reemerged and been termed Artificial General Intelligence (AGI). However, since the term *Artificial Intelligence* is often mistakenly used to describe both AI and AGI, confusion among the general population often ensues.

Read Part 1: Human Level Artificial Intelligence 2016: Artificial General Intelligence and then some:
https://techxplore.com/news/2016-09-human-artificial-intelligence.html

Enter the Artificial General Intelligence Society – a nonprofit organization dedicated to promoting the study and design of AGI systems, as well as to facilitate, publicize and facilitate of AGI knowledge though conferences, publications and other venues. In particular, the annual AGI Conference Series on Artificial General Intelligence – now in its ninth year – has been fundamental to the revitalization of AGI through interdisciplinary research and novel approaches to understanding intelligence.

This year's conference, AGI-16 (which was held in New York City on July 16-19 at the New School, the proceedings of which will be published in Springer's Lecture Notes in AI series and the papers available online) had a new wrinkle – namely, for the first time it was part of the Human-Level Intelligence 2016 (HLAI-16) event, along with the 2016 Annual International Conference on Biologically Inspired Cognitive Architecture (BICA 2016), the Eleventh International Workshop on Neural-Symbolic Learning and Reasoning (NeSy'16), and the Fourth International Workshop on Artificial Intelligence and

Cognition (AIC 2016).

Given the presence of multiple organizations at this year's conference, it's not hard to imagine the number of papers and range of subjects presented. Accordingly, select talks and panel discussions in a range of research areas will be summarized, including cognitive models, consciousness, emotion, and Virtual Reality in Part 1; and neuromorphic architectures, robotics, and creativity – as well as links to videos of an AGI Tutorial, panel discussions and Prize Awards – in Part 2.

The brainchild of Carver Mead at Caltech in the late 1980s, *neuromorphic computing* is a biomimetic technology that uses analog VLSI circuits modeled on *in vivo* neurobiological architecture. The advantage of a neuromorphic approach to biologically-inspired cognitive architecture – a focal point at BRAIN Initiative, IBM, Human Brain Project, and Institute of Neuromorphic Engineering, among other organizations – is that like the brain, neuromorphic computing excels at novelty, complexity and ambiguity (if not the speed and precision of digital computers), as well as in facial recognition, bipedal locomotion and other practical tasks such. That said, however, the downside to this promising approach is that to solving problems, current neuromorphic computing architectures require extensive design and implementation resources. To address this, researchers Adam Disney, John Reynolds, Catherine Schuman, Aleksander Klibisz, Aaron Young and James Plank devised the DANNA (Dynamic Artificial Neural Network Array) neuromorphic software ecosystem, which as described in their paper[9] expedites DANNA application development, thereby contributing to the process of making the DANNA model more effective.

Marek Otahal, Olga Stepankova and Michal Najman presented *Design of Neuromorphic Cognitive Module based on Hierarchical Temporal Memory and demonstrated on Anomaly Detection*, a talk proposing the integration of a biologically-inspired artificial neural network and a biological neural network, the goal being to "extend or enhance cognitive and sensory capabilities…by associating existing and artificial sensory inputs." The other main component of their proposed design is Hierarchical Temporal Memory (HTM), a biologically-inspired model of the mammalian neocortex (specifically, the latter's six-layer columnar stack). The researchers conducted a case study that used a "complex task of contextual anomaly detection" to "evaluate capabilities of an HTM module on a specifically designed synthetic dataset and propose improvements to the anomaly model." (Anomaly detection identifies data points, items, observations, or events that do not conform to the expected pattern in a dataset or other group.) They concluded that Hierarchical Temporal Memory "is a plausible and useful model for designing a direct brain-extension module" as well as a preliminary neuromorphic interface for processing asynchronous inputs.

As described in his online interdisciplinary Research Statement[10], Malte Schilling gave an interesting, somewhat whimsically-titled presentation, *Lose a leg but not your head—extension of a biologically-inspired walking architecture towards a cognitive system*, in which he discussed his cognitive extension for a six-legged robot behavior-based control system. Based on Walknet[11] – a decentralized architecture developed by Schilling, Holk Cruse and Paolo Arena comprising peripheral pattern generators coordinated through influences acting primarily between neighboring legs – stable and adaptive walking emerges that enables the robot to manage novel situations. Moreover, a cognitive systems approach lets the robot plan ahead by using an internal mental simulation of its body.

Agnese Augello, Ignazio Infantino, Adriano Manfrè, Giovanni Pilato, and Filippo Vella demonstrated the synthesis of cognitive architecture, robotics and creativity in *Analyzing and discussing primary creative traits of a robotic artist*, a discussion based on their paper[12] of the same title in which they presented "a robot aimed at producing a collage formed by a mix of photomontage and digital collage…after a visual and verbal interaction with an human user." The robotic artist becomes inspired through "postural and verbal interaction with the human user" (including social media), an internal model of the artwork arrived at through creative thinking, and then composing and titling the collage. The paper explains these processes as well as factors such as "how the personality and the artistic behavior are modeled by learning and evaluations, motivation, and the confidence evolution as a function of successes or failures."

AGI Tutorial

David Hanson and Ben Goertzel
Social and Emotional Robots as a Playground for Early-Stage AGI Systems (video)

Panel Discussions

HLAI Final Panel (video)

General Chair Tarek Richard Besold asks the panel members to reflect on the conference and progress in AGI. From left to right: Pei Wang, Alexei Samsonovich, Luciano Serafini, Paul S. Rosenbloom, Ben Goertzel and Jordi Bieger.

AGI-16 Panel Discussion: *Can Deep Neural Networks solve the problems of AGI?* (video)

From left to right: Pei Wang, Brandon Rohrer, Cosmo Harrigan, and Leslie Smith

Individual presentations:

Pei Wang (video)
AGI via DL?

Leslie Smith (video)
Deep neural networks: the only show in town?

Brandon Rohrer (video)
Deep neural networks can't make AGI

Cosmo Harrigan (video)
Deep Learning for AGI: Survey of Recent Developments

AGI Prize Awards

Winner of the OpenCog Foundation Prize for Best Student Paper (video)

Garrett Katz, Di-Wei Huang, Rodolphe Gentili and James Reggia
Imitation Learning as Cause-Effect Reasoning

Winner of the Kurzweil Prize for Best AGI Idea (video)

David Weinbaum and Viktoras Veitas
Open Ended Intelligence

Winner of the Kurzweil Prize for Best AGI Paper (video)

Tom Everitt, Daniel Filan, Mayank Daswani and Marcus Hutter
Self-Modification of Policy and Utility Function in Rational Agents

More information: Read Part 1: Human Level Artificial Intelligence 2016: Artificial General Intelligence and then some: techxplore.com/news/2016-09-hu … al-intelligence.html

[9]DANNA: A neuromorphic software ecosystem, *Biologically Inspired Cognitive Architectures*Volume 17, July 2016, pp. 49–56, doi:10.1016/j.bica.2016.07.007

[10]From Sensorimotor Control towards Cognition, *Research Statement*

[11]Hexapod Walking: an expansion to Walknet dealing with leg amputations and force oscillations," *Biological Cybernetics*, March 2007, Volume 96, Issue 3, pp. 323–340, doi:10.1007/s00422-006-0117-1

[12]Analyzing and discussing primary creative traits of a robotic artist, *Biologically Inspired Cognitive Architectures*, Volume 17, July 2016, pp. 22–31, doi:10.1016/j.bica.2016.07.006