Special Track: **Neuro-inspired Artificial Intelligence**

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http://www.isvc.net

Scope

We propose the Neuro-inspired AI track that focuses on research that integrates themes in neuroscience that have yet to be thoroughly explored in machine learning and artificial intelligence. The current state-of-the-art is dominated by deep learning; however, recent research has uncovered critical issues that limits its advancement. While deep learning has had incredible success, especially when used in narrow, supervised settings, deep learning needs huge labeled databases to be successful. But, new breakthroughs in intelligence will not simply come from using more labeled data. As noted by LeCun, Bengio, and Hinton, "... we expect unsupervised learning to become far more important in the longer term. Human and animal learning is largely unsupervised: we discover the structure of the world by observing it, not by being told the name of every object."

Traditional supervised models are also susceptible to adversarial attacks and are easily fooled. For example, small perturbations in the pixel intensities of an image that are imperceptible to humans, can easily alter the output to a target class. This can partially be attributed to the fact that most supervised learning is based upon discriminative learning algorithms. In other words, it models the decision boundary between classes instead of modeling the distribution of classes themselves. Current AI models are also not robust to out-of-distribution data (e.g., ImageNet-C, ImageNet-R, ObjectNet). The out-of-distribution datasets includes cases that naturally happen during model deployment. For example, ImageNet-C provides a standard perturbation benchmark that simulates 75 real-world corruption examples that illustrate the weaknesses of current models.

In general, neural networks have gradually moved away from biological thematics. This has largely been due to engineering breakthroughs and brute force tactics in the past several years that have transformed the field of machine learning. Further engineering of these networks is reaching a saturation point where incremental novelty in the number of layers, activation function, parameter tuning, gradient function, etc., is only producing incremental accuracy improvements. Although there is evidence that AI has reached human levels on certain narrowly defined tasks, for general applications, biological AI remains far superior to that of any computer. Evidence from neuroscience suggest algorithmic and architectural methodology that could drive exciting and new research directions. For example, 95% of synapses in cortex are not related to feed-forward bottom-up drive but rather reflect local inhibitory, long-range lateral and top-down feedback projections, pathways that are mostly ignored by deep learning architectures. Spike timing may be a critical aspect of biological information encoding that have been abstracted away from current ML frameworks. Given the independent advances in neuromorphic software and hardware, machine learning, and neuroscience, the fields are again well positioned for cross pollination.

Topics

Topics of interest include but are not limited to:

- Neuromorphic Computing
- Spiking Neural Networks
- Self-supervised/ Unsupervised Learning
- Learning with Less Labels
- Robust Classification
- Generative Machine Learning
- Biologically Plausible AI
- Sparse Coding
- Sparse Distributed Representations
- Energy Efficient Machine Learning
- Top-Down Feedback in Machine Learning
- Inhibitory and Excitatory Lateral/Feedback connections
- Cognitive Neural Architectures
- Non-von Neumann computing architectures and models
- Event based systems

Organizers

Edward Kim, Drexel University, USA
Yijing Watkins, Pacific Northwest National Laboratory, USA
Garrett T. Kenyon, Los Alamos National Laboratory, USA

Important Dates

See http://www.isvc.net/

Paper Submission

See http://www.isvc.net/index.php/paper-submission/