



# The Foundations of Deep Learning with a Path Towards General Intelligence

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# Postulates of General AI

- » Completeness »
- » Stochastic Models
- » Bayesian Prediction
- » Principle of Induction
- » Practical Approximation
- » Incremental Learning
- » Modularity and Scalability
- » Cognitive Architecture



# Postulates of Deep Learning

- » Epistemic Non-reductionism
- » Eliminative Materialism
- » Subsymbolic & Distributed Representation
- » Universal Approximation
- » Deep Models
- » Hierarchy and Locality
- » Gradient Descent
- » Dataflow Models & SIMD Architectures



# Shortcomings and Generality of Deep Learning

## » Shortcomings:

- » Too many examples

- » Mostly supervised learning

## » Generality postulates questioned:

- » Completeness ~ Universal Approx. theorems

- » Dataflow models can extend to Turing-complete



# Shortcomings & Extensions of DL

## » Extensions:

### » Program-class extensions:

- » Differentiable Neural Computer

### » Non-Euclidian embeddings:

- » Handles complex data types

### » Stochastic models

- » Can deal with uncertainty

### » Inductive generalization

- » Information bottleneck

### » Adaptive architectures

- » Layer augmentation

- » Neuro-evolution

### » Transfer learning

- » Neural task memory

### » Modularity

- » Capsule Nets

- » Hawkins's Dendritic Computation

### » Cognitive Architectures

- » Deep Mind I2A, PathNet

- » Friston's Deep Temporal Models



# Questions?

— Please send them to [examachine@gmail.com](mailto:examachine@gmail.com)