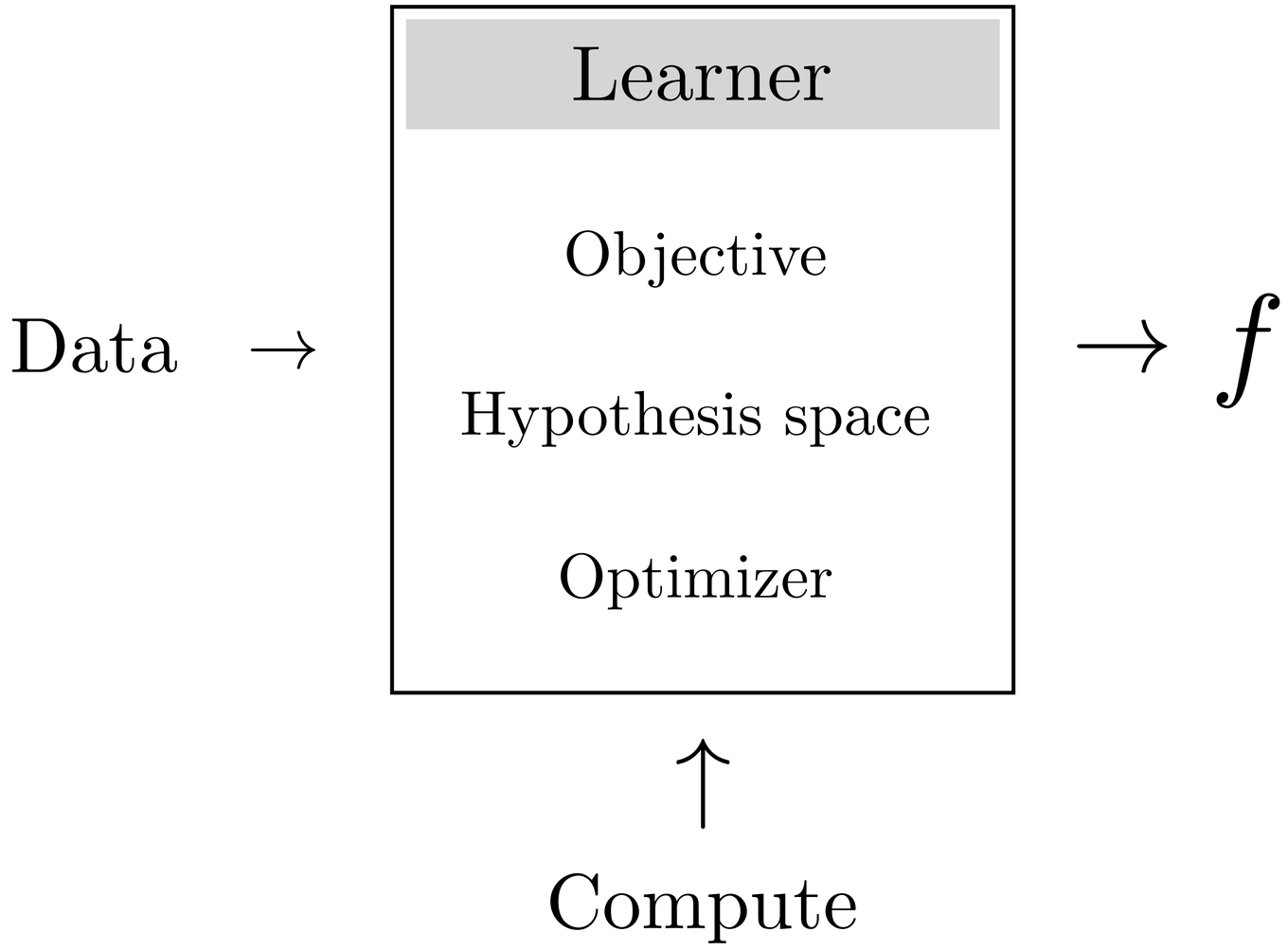
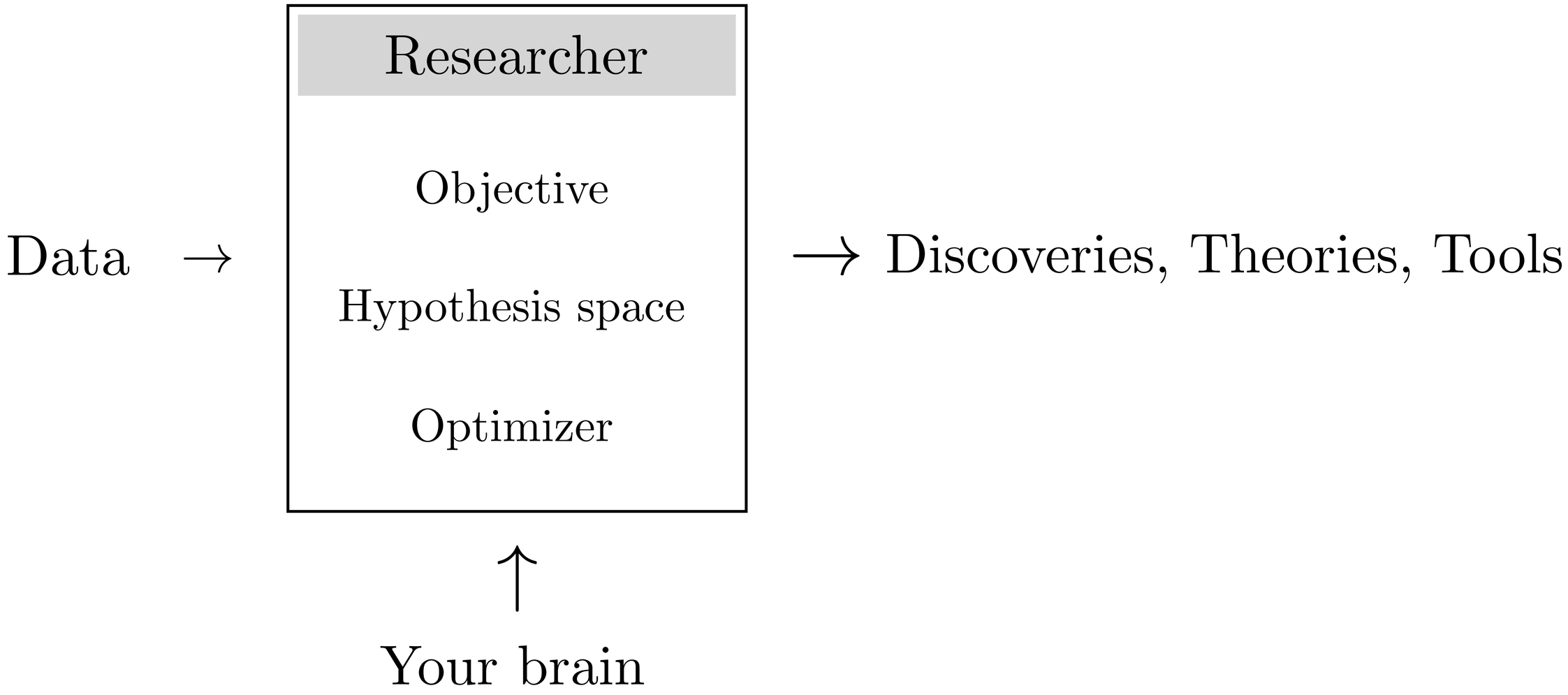
How to do research

Phillip Isola


Learner
Objective
Hypothesis space
Optimizer
Data
$\rightarrow$
$\rightarrow f$
$\uparrow$
Compute


Data
Researcher
Objective
Hypothesis space
Optimizer
Discoveries, Theories, Tools
Your brain

There are many ways to conribute

Tools

BVLC / caffe

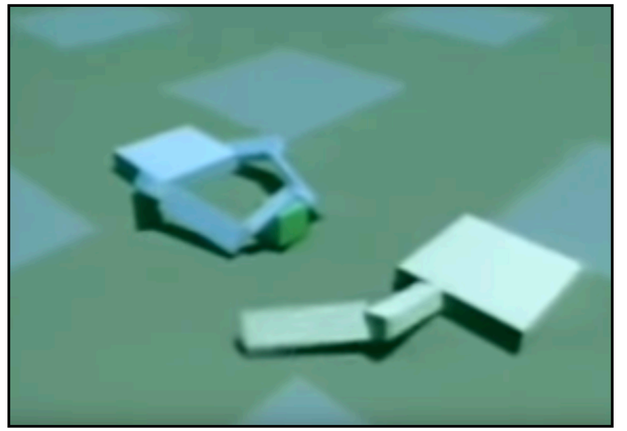
Watch 2,236 | Unstar 26,339 | Fork 16,041

Code | Issues 629 | Pull requests 263 | Projects 0 | Wiki | Insights

Caffe: a fast open framework for deep learning. http://caffe.berkeleyvision.org/

deep-learning | machine-learning | vision

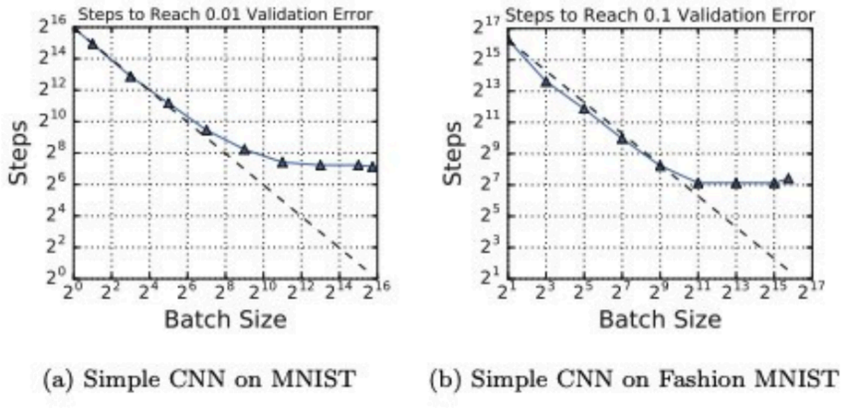
Creativity



Theory

Theorem 4. *(weak* topology) Let* $\{\mathbb{P}_n\}$ *be a sequence of distributions. Considering* $n \to \infty$*, under mild Assumption,* $\max_\phi M_{f_\phi}(\mathbb{P}_\mathcal{X}, \mathbb{P}_n) \to 0 \iff \mathbb{P}_n \xrightarrow{D} \mathbb{P}_\mathcal{X}$*, where* $\xrightarrow{D}$ *means* converging in distribution *[3].*

Empiricism



(a) Simple CNN on MNIST (b) Simple CNN on Fashion MNIST

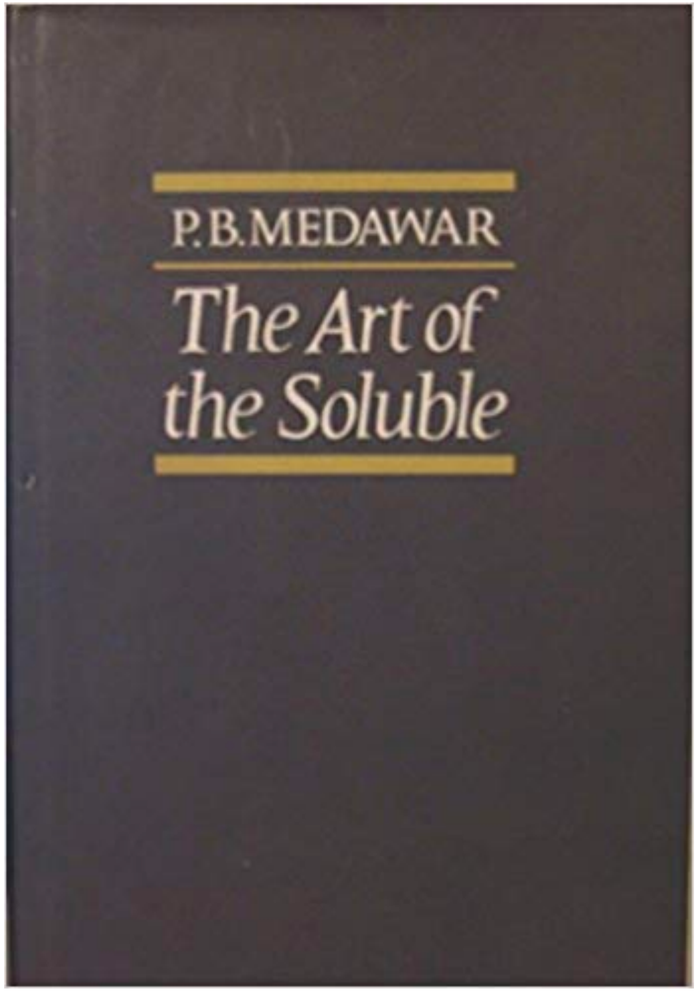
Communication

Andrej Karpathy blog About Hacker's guide to Neural Networks

The Unreasonable Effectiveness of Recurrent Neural Networks

May 21, 2015

Science is the “Art of the Soluble”



“‘Good scientists study the most important problems they think they can solve. It is, after all, their professional business to solve problems not to grapple with them.’ —Peter Medawar”
— Jitendra Malik

Reviews

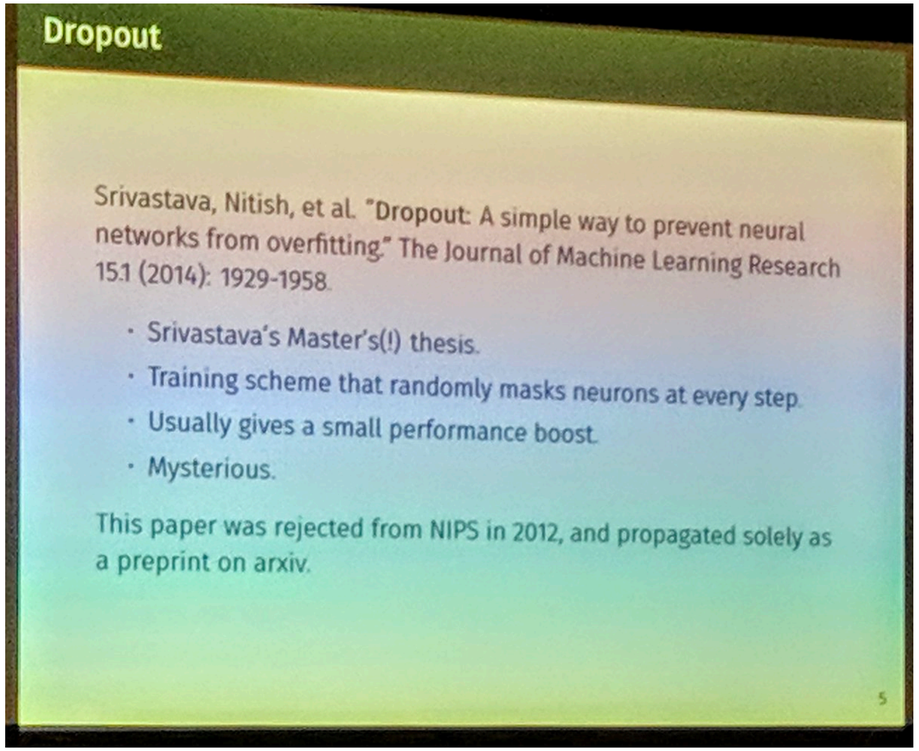
“The theoretical work is primitive, and the experiments are pretty basic.”

“In the present form the submission may not yet be quite strong enough for NIPS. But the authors should be encouraged to pursue this further, perhaps for the next ICML or NIPS?”

Neural Networks for Machine Learning

Lecture 6e
rmsprop: Divide the gradient by a running average of its recent magnitude

Geoffrey Hinton
with
Nitish Srivastava
Kevin Swersky



Identify limitations

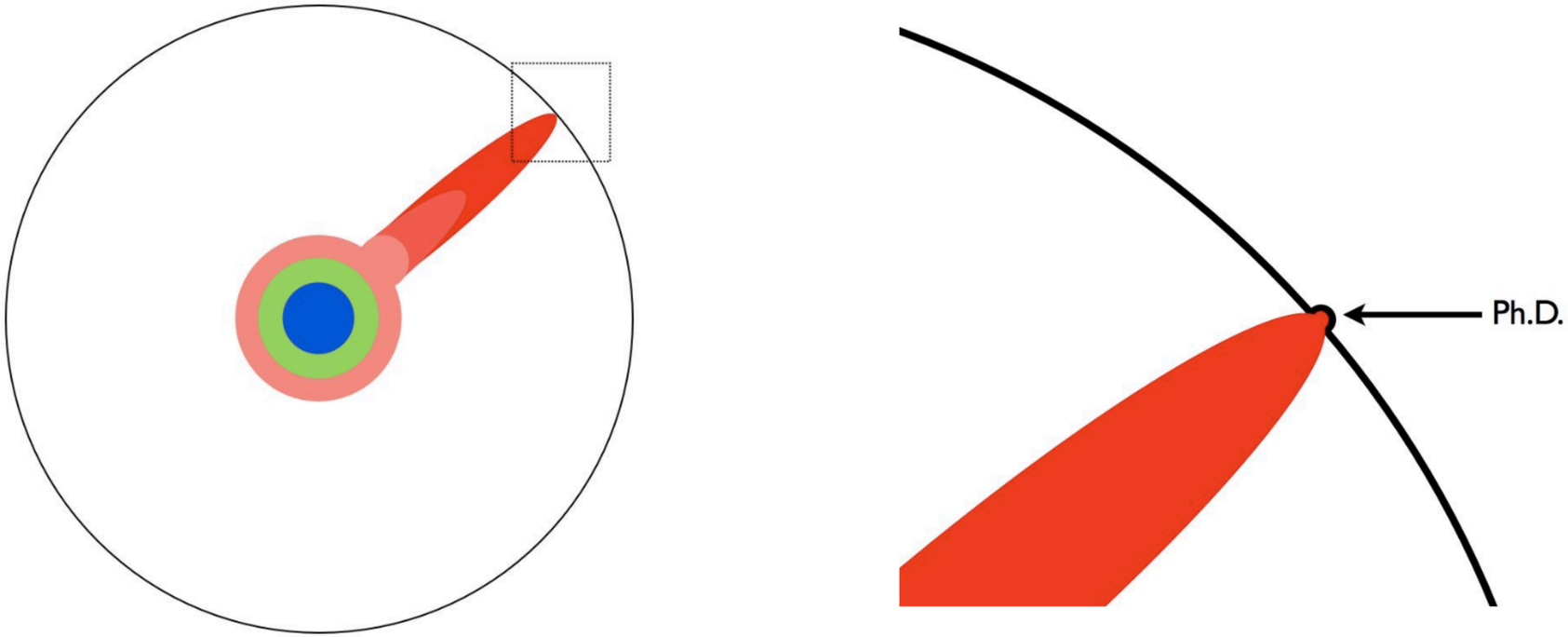
	Method	Train on data	One-pass Sampling	Exact log-likelihood	Free-form Jacobian
	Variational Autoencoders	✓	✓	✗	✓
	Generative Adversarial Nets	✓	✓	✗	✓
	Likelihood-based Autoregressive	✓	✗	✓	✗
Change of Variables	Normalizing Flows	✗	✓	✓	✗
	Reverse-NF, MAF, TAN	✓	✗	✓	✗
	NICE, Real NVP, Glow, Planar CNF	✓	✓	✓	✗
	FFJORD	✓	✓	✓	✓

Table 1: A comparison of the abilities of generative modeling approaches.

Novelty

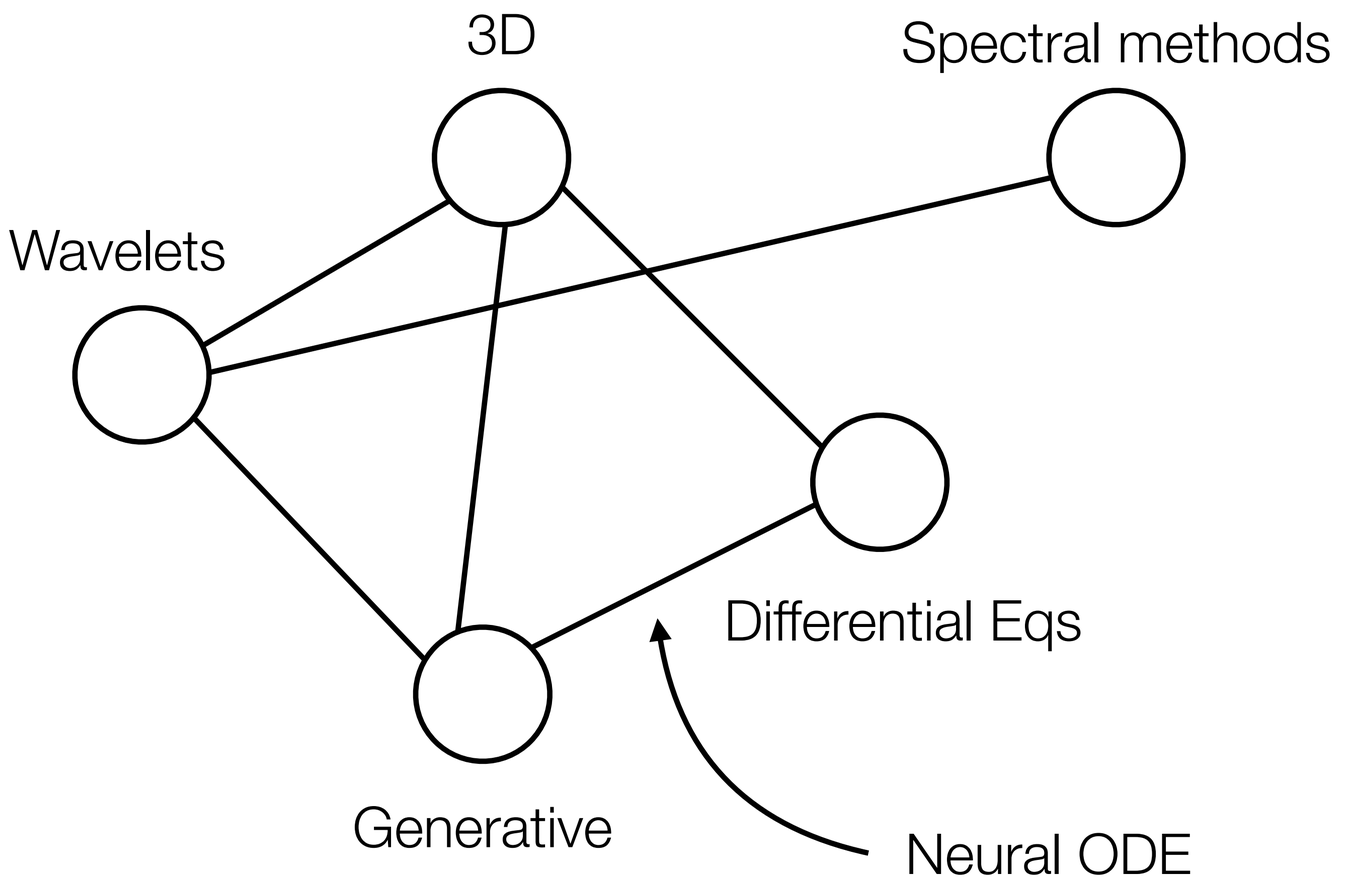
What matters is novelty w.r.t. humanity

Very hard to achieve without knowing what has already been done.

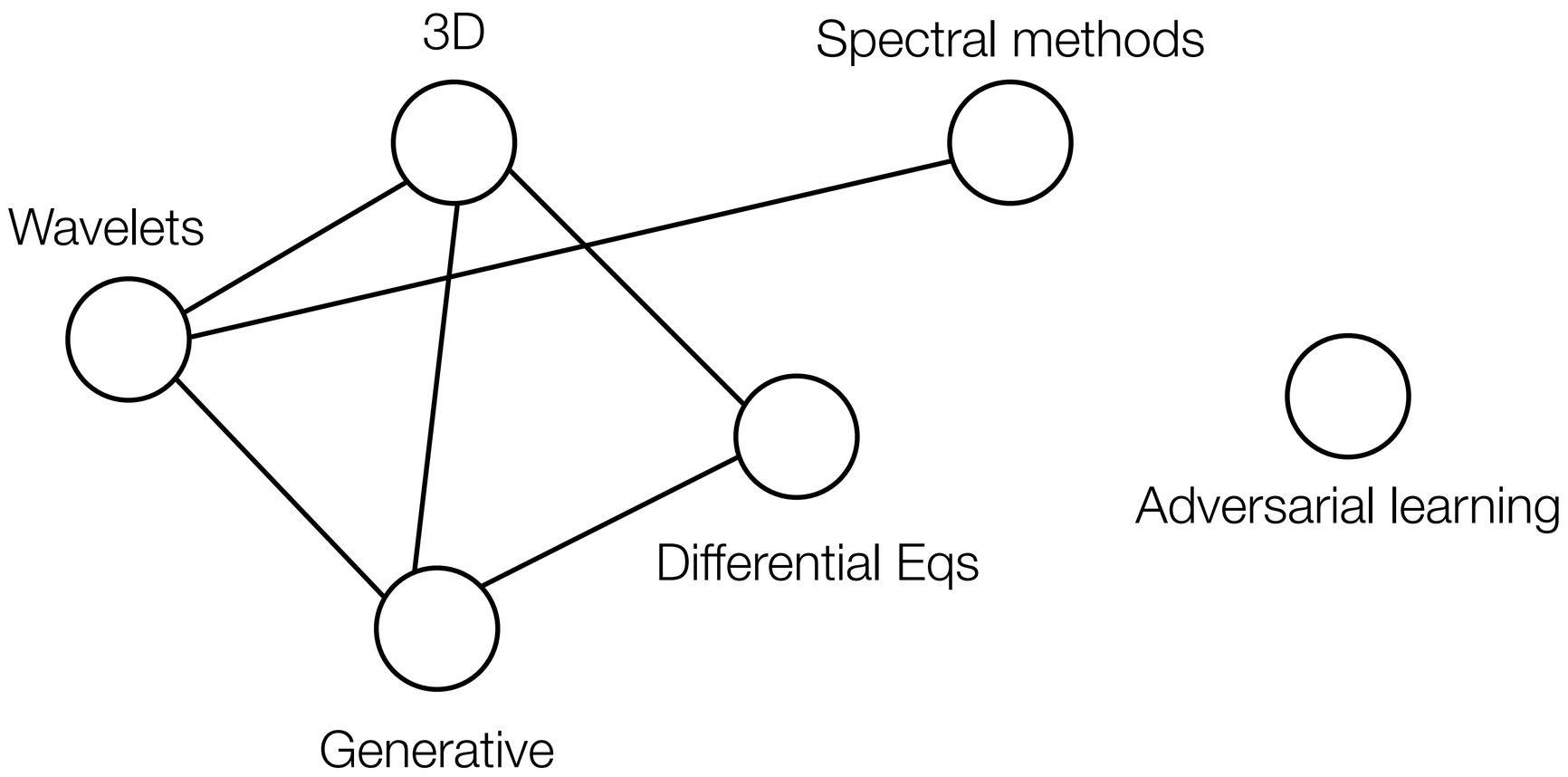


http://matt.might.net/articles/phd-school-in-pictures/

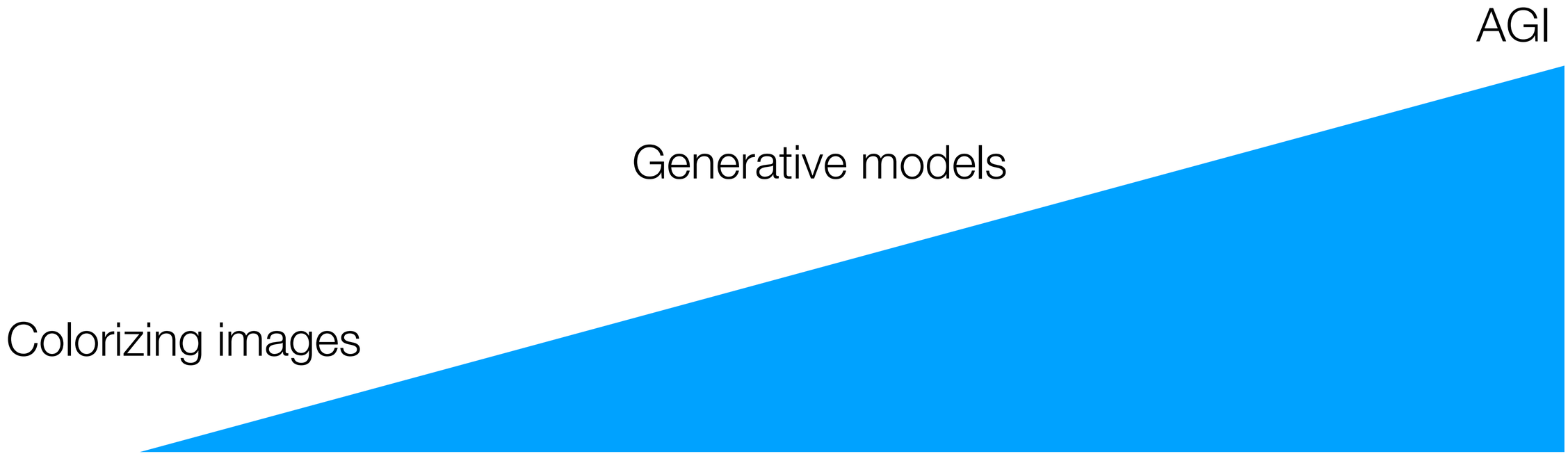
Add an edge


3D
Spectral methods
Wavelets
Differential Eqs
Generative
Neural ODE

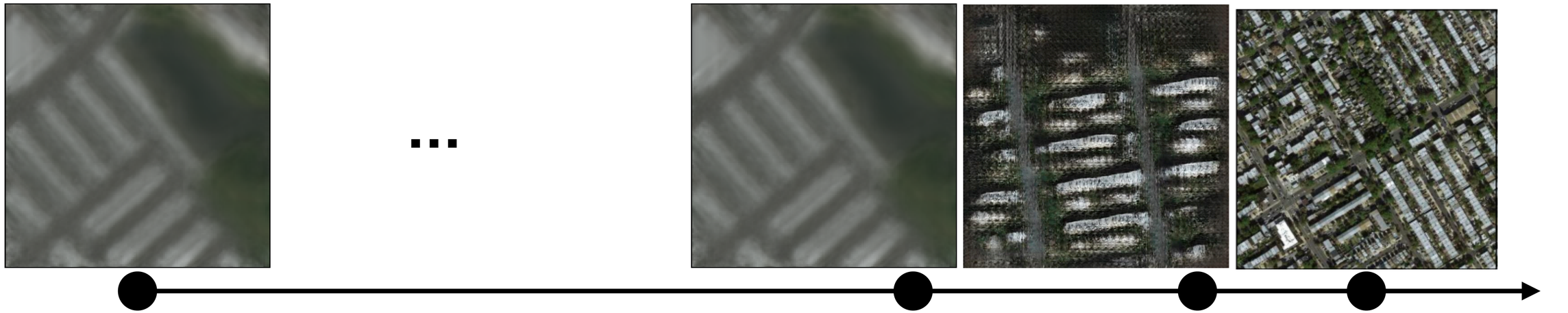
Add a node


3D
Spectral methods
Wavelets
Differential Eqs
Adversarial learning
Generative

Build a ramp

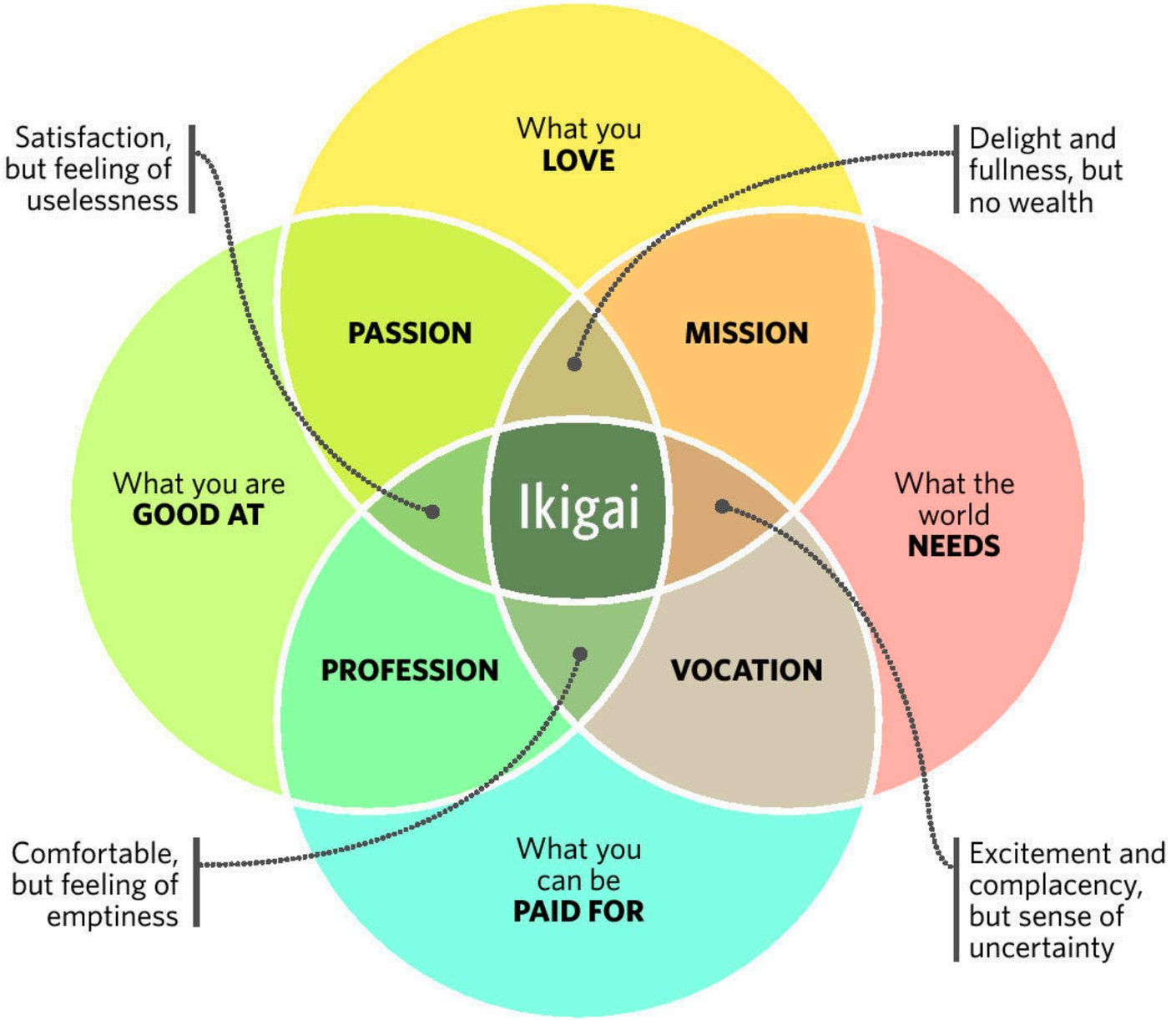


Research takes time



Ikigai

A JAPANESE CONCEPT MEANING "A REASON FOR BEING"



SOURCE: dreamstime

TORONTO STAR GRAPHIC