

Shuai Li

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EDUCATION

2015 – 2017 **Master of Philosophy, Electronic Engineering**
CHINESE UNIVERSITY OF HONG KONG (CUHK)
2010 – 2014 **B.E. Computer Science (CS), Special Class for Gifted Young (SCGY) Program**
UNIVERSITY OF SCIENCE AND TECHNOLOGY OF CHINA (USTC)

EMPLOYMENT

2017.8 – PRESENT **Researcher Associate @ South China University of Technology (SCUT)**
2014.8 – 2015.8 **Research Assistant @ Chinese University of Hong Kong (CUHK)**
2014.1 – 2014.5 **Research Intern @ Microsoft Research Asia (MSRA)**

RESEARCH EXPERIENCE

JUNE 2012 – PRESENT

Theory of Neural Networks The theory gives S-System, **a measure-theoretical definition of NNs**; endows a stochastic manifold structure on the intermediate feature space of NNs through information geometry; proposes a learning framework that unifies both supervised learning and unsupervised learning in the same objective function; and proves **under practical conditions**, for **large size nonlinear deep NNs** with a class of losses, including the hinge loss, **all local minima are global minima** with zero loss errors. It also completes the analogy between NNs and Renormalization Group. (manuscript available at <https://arxiv.org/abs/1811.12783>),

JAN 2018 – JULY 2018

Loss Landscape of NNs We study the loss landscape of NNs, and prove that under a set of practical boundedness and diversity conditions, for large-size nonlinear deep NNs with a class of losses, including the hinge loss, all local minima are global minima with zero loss errors. We emphasize that the assumptions made are sufficient practice-guiding preconditions. Intuitively, the conditions ask the neurons in a NN to be cooperative yet stay autonomous to the majority of the neuron

population. The conditions are directly related to the centering, and normalization techniques widely used in practice to make NNs optimizable. For more info, refer to http://shawnleezx.github.io/research_catalog.

NOV 2018 – JAN 2019

Adversarial Robustness and Generalization We study why the degradation in standard accu-

racy occurs from the statistical perspective when adversarial robustness is added to adversarial samples through adversarial training. More specifically, with a mix of theory and experiments, we show that adversarial robustness is a form of drastic regularization that hurts the capacity of NNs and results in performance degradation, when adversarial noises are prevented from being amplified too much through spectral normalization. For more info, refer to http://shawnleezx.github.io/research_catalog.

JAN 2018 – APR 2018

Orthogonal Neural Networks I am also in-

involved with designing algorithms to improve neural networks (NNs). The new algorithm constrains the weight matrices of NNs to be orthogonal. It is theoretically inspired by **a novel generalization error bound** that goes beyond Lipschitz constant based bounds through a new covering scheme. It characterizes the error induced by erroneous expansion of intra-class variations, and erroneous contraction of inter-class difference. The analysis relies on the proof that NNs are local δ -isometry by breaking the instance space down by their hyperplane arrangement, and bounds the singular values according to Cauchy interlacing law. For more info, refer to http://shawnleezx.github.io/research_catalog.

PROGRAMMING EXPERIENCE

Nov 2015 – Nov 2017

Akid (Python)

Neural Network library

* akid is a python neural network package that uses dataism abstraction on backends (Tensorflow, or PyTorch are supported) for research in NNs. It supports Acyclic Directed Computational Graph, Multi-GPU Computing, Visualization (computation graph, weight filters, feature maps, and training dynamics statistics), Meta-Syntax to generate network structure and more.

* LeNet, AlexNet, Maxout Net, VGGNet, Residual Network are reproduced.

* For detail, refer to <http://arxiv.org/abs/1701.00609> (report) and <http://akid.readthedocs.io> (doc)

SKILLS

Programming

PROFICIENT	Common Lisp, C/C++, Python, Shell Script, Matlab(Octave)
WARMUP IN FORTNIGHT	Java, Elisp, VimL, Prolog, Javascript, HTML, CSS, XML, YAML, Ruby, Lua, SED, AWK, SQL, Action Script, Assembly Language, Verilog

Technology

Linux, Emacs, Vim, Eclipse, Eclim
Chef, Docker, Kubernetes, GlusterFS, Hadoop