# Baifeng Shi

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## EDUCATION BACKGROUND

**Peking University**, Beijing, China — Expected 07/2021
*B.S., Computer Science*

- Overall GPA:**3.80** / 4
- Standard Tests: TOEFL 108 (Speaking 23) / GRE 332 (AW 3.5)
- Programming languages: C/C++, Python, MATLAB, R, LaTeX
- Awards and Honors:
  - **Gold Medal** (3 / 360), Chinese Physics Olympiad final contest — 10/2016
  - **First Class Golden Award**, 12th Pan-Pearl River Delta and Chinese Elite Schools Physics Olympiad — 02/2016
  - EECS Dean Scholarship, Peking University — 09/2017
  - Merit Student, Peking University — 09/2018

## PUBLICATIONS

- **Baifeng Shi**, Judy Hoffman, Kate Saenko, Trevor Darrell, Huijuan Xu, *Auxiliary Task Reweighting for Minimum-data Learning*, **NeurIPS 2020 submitted**
- Zhekun Luo, Devin Guillory, **Baifeng Shi**, Wei Ke, Fang Wan, Trevor Darrell, Huijuan Xu, *Weakly-Supervised Action Localization with Expectation-Maximization Multi-Instance Learning*, **ECCV 2020**
- **Baifeng Shi***, Dinghuai Zhang*, Qi Dai, Zhanxing Zhu, Yadong Mu, Jingdong Wang, *Informative Dropout for Robust Representation Learning: A Shape-bias Perspective*, **ICML 2020**
- **Baifeng Shi**, Qi Dai, Jingdong Wang, Yadong Mu, *Weakly-Supervised Action Localization by Generative Attention Modeling*, **CVPR 2020**

## RESEARCH EXPERIENCE

*Independent research, advised by Dr. Huijuan Xu and Prof. Trevor Darrell* — *UC Berkeley*
**Unsupervised Foreground Mining for Omni-supervised Action Localization (Ongoing)** — 06/2020 – present

- Built a baseline for consistency-based semi-supervised action localization, and designed temporal augmentation for video data
- Designed a unified framework for semi-supervised and weakly-supervised action localization.
- Built a graphical causal model of the foreground/background action in neighboring frames, and proposed to extract foreground by minimizing the conditional mutual information between foreground and background motion.

*Independent research, advised by Dr. Huijuan Xu and Prof. Trevor Darrell* — *UC Berkeley*
**Auxiliary Task Reweighting for Minimum-data Learning** — 03/2020 – 06/2020

- Addressed the problem of automatically reweighting multiple auxiliary tasks to learn the main task with minimum information (supervision).
- Exploited the key insight that *information required for inference can be reduced by a good prior*, and formulated the problem as optimizing the KL divergence between the true prior and the surrogate prior given by the weighted likelihood of auxiliary tasks.
- Utilized tools and concepts including Fisher score and Langevin dynamics, and further simplified the optimization of the KL divergence into minimizing the l2 distance between main/auxiliary task gradients, which gives a light-weight algorithm to reweight auxiliary tasks on-the-fly.
- Derived theoretical guarantees that our algorithm finds the optimal task weights up to a small error.
- Experimentally observed that our algorithm finds the optimal task weights and minimizes the data requirement under various settings, *e.g.*, semi-supervised learning, domain generalization, and multi-label classification.
- One paper is submitted to NeurIPS 2020.

*Independent research, mentored by Dr. Qi Dai, Dr. Jingdong Wang, and Prof. Yadong Mu* — *Microsoft Research Asia*
**Human Vision Inspired Shape-bias for Model Robustness** — 11/2019 – 02/2020

- Analyzed the relationship between the texture-bias of CNN and its multiple kinds of vulnerability.
- Proposed to discriminate texture from shape by the self-information in an image, resembling the mechanism of saliency detection and eye movement in the human visual system.
- Proposed a Dropout-like algorithm to de-correlate the model output with the texture information in the input, thus enhancing the shape-bias of the model.
- Conducted experiments under different scenarios (domain generalization, few-shot classification, image corruption, and adversarial perturbation) and observed a universal improvement in model robustness.
- The work is summarized in a paper and accepted to ICML 2020.

*Independent research, mentored by Dr. Qi Dai, Dr. Jingdong Wang, and Prof. Yadong Mu* *Microsoft Research Asia*

**Weakly Supervised Action Localization** 08/2019 – 11/2019

- Tackled with a common challenge in weakly supervised action localization, namely action-context confusion.
- Built a probabilistic graphical model and formulated the problem as modeling the frame-wise class-agnostic likelihood and optimizing the maximum a posteriori (MAP) estimation.
- Proposed to separate foreground and context by modeling the appearance-level frame likelihood using a generative model, *viz.* conditional variational auto-encoder (CVAE).
- Improved the results on two common datasets by a large margin (10% relative improvement).
- The work is summarized in a paper and accepted to CVPR 2020.

*Independent research, advised by Prof. Yadong Mu* *Machine Intelligence Lab, Peking University*

**Fast Video Understanding with Reinforcement Learning** 10/2018 – 08/2019

- Proposed an algorithm to use as few frames as possible to classify a video while preserving an expected accuracy.
- Formulated the reward function as the Lagrangian of the constrained optimization problem, and optimized it using reinforcement learning algorithm, *viz.* soft actor-critic (SAC).
- Boost the original algorithm by 400% while preserving the accuracy.

## SELECTED PROJECTS

**Neural Decoding of Rhesus Monkey's Primary Motor Cortex (M1)**

*Advised by Prof. Bo Hong*

- Preprocessed the spike rate and kinematics record from raw data.
- Decoded hand movement from the population code of primary motor cortex using LASSO.
- Estimated the tuning curve of M1 neurons and their preferred direction.
- Took the temporal consistency of motion into consideration, and use Kalman Filter to improve the decoding accuracy.

**An Upper Bound on Adversarial Robustness and its Dependency on Model's Performance**

*Advised by Prof. Liwei Wang and Prof. John Hopcroft*

- Theoretically proved an upper bound of adversarial robustness of an arbitrary model and analyzed its dependency on model's performance.
- Showed as the main result that this upper bound will get lower as performance improves.
- Conducted several experiments and heuristically proved our claim.

**Towards Efficient methods for Margin Maximization in ReLU Networks**

*Advised by Prof. Liwei Wang*

- Developed an algorithm to improve adversarial robustness of ReLU networks based on spectral norm regularization.
- Designed an algorithm to calculate spectral norm of convolutional layers more accurately and efficiently.