Zihao Hu

Curriculum Vitae

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Research Interests

Computer Vision *Supervised Hashing*

Machine Learning *Probabilistic Inference*

Education

2015–Now **M.S. in Computer Technology**, *Shanghai Jiao Tong University*, Advisor: Prof. Hongtao Lu.

- Major GPA: 3.02/3.30, Rank: 3/115, Expected Graduation Date: 2018.3.31.
- Good **math** training: all of 5 math courses are above A and 3 of them are over A+.
- Area of Research: Image Retrieval/Probabilistic Inference and Optimization.

2011–2015 **B.E. in Telecommunications Engineering**, *Huazhong University of Science and Technology*.

- Research Intern Advisor: Prof. Xiang Bai.
- Major GPA: 84.71/100, Rank: 36/212.

Honors and Awards

2017 **National Scholarship,China** *Highest scholarship in China, Top 2.6%*

2017 **Student Travel Scholarship** *CVPR 2017*

2017 **Two Sigma Financial Modeling Challenge in Kaggle** *Top 7.15%*

2016 **First Prize in China Post-Graduate Mathematical Contest in Modeling** *Top 1.69%*

2016 **Academic Excellence Scholarship (first-class) of Shanghai Jiao Tong University**

Publications

Zihao Hu, Xiyi Luo, Hongtao Lu. "Supervised Hashing based on Energy Minimization". Submitted to the **Thirty-Second AAAI Conference on Artificial Intelligence (AAAI 2018)**.

Zihao Hu, Junxuan Chen, Hongtao Lu, Tongzhen Zhang. "Bayesian Supervised Hashing". **Spotlight** of the **IEEE Conference on Computer Vision and Pattern Recognition 2017 (CVPR 2017, 8%)**.

Wei Shen, Xiang Bai, **Zihao Hu**, Zhijiang Zhang. "Multiple Instance Subspace Learning via Partial Random Projection Tree for Local Reflection Symmetry in Natural Images" **(PR 2016)**.

Research Experience

Supervised Hashing

Goal Learning compact binary codes to fasten retrieval speed while preserving semantic information.

Advisor Hongtao Lu, Center for Brain-like Computing and Machine Intelligence, SJTU, China.

4.2017–7.2017 **Supervised Hashing based on Energy Minimization**.

In this work, I viewed the supervised hashing problem as learning marginals in a CRF. By adopting the mean field approximation, a set of consistency equations can be obtained. I provided a local linear approximation to these equations, and solved the resulting linear systems to obtain an approximate fixed point of original consistency mappings. By using this technique, learning 64-bit hashing codes on NUS-WIDE (≈270,000 images) costs less than 20 seconds.

- This work is able to incorporate various supervised hashing formulations in a unified manner.
- The space cost is refined from $\mathcal{O}(nd^2)$ in my CVPR paper *Bayesian Supervised Hashing* to $\mathcal{O}(nd)$.

6.2016–9.2016 **Bayesian Supervised Hashing**.

http://bcmi.sjtu.edu.cn/∼zihaohu/papers/cvpr2017.pdf
This is the first work that adopted probabilistic inference techniques to tackle the supervised hashing problem. The variational inference technique can tune hyperparameters of the model automatically. In addition, the automatic relevence determination (ARD) prior is utilized to figure out relative significance of different hashing bits.

Mining Financial Data

12.2016–1.2017 **Two Sigma Financial Modeling Challenge**.

This is a competition held by Kaggle. I worked with two other team members to construct an ensemble model to predict a volatility index. During the process, I learned how to perform feature engineering in real data, and how to ensemble different models to capture the complex structure in the data.

Sensor Networks

Advisor Xiaofeng Gao, Department of Computer Science and Engineering, SJTU, China.

5.2016–6.2016 **Border Intrusion Detection with Mobile Robots**.

Given some mobile robots with the same monitoring radius in a rectangle area. The task is to minimize movements of all robots to ensure that any intrusion across a border can be detected by at least one robot.

- When the border is a line segment, I converted the problem to a linear programming problem.
- When the border is non-linear, I reduced from Hamiltonian Circuit to prove its NP-hardness.

Research Notes

An Approximate Solution for Consistency Equations.

http://bcmi.sjtu.edu.cn/∼zihaohu/notes/consistencyequations.pdf
This note showed a technique to approximate a fixed point of consistency mappings deriving from mean field inference. I derived a linear approximation to the sigmoid function, then converted these equations to linear systems, which have a closed-form solution. This idea may also be used to solve an approximate solution for other energy functionals, like the Bethe free energy. I adopted this technique in my recently submitted **AAAI** paper "Supervised Hashing based on Energy Minimization".

A Detailed Derivation for Mean Field Dirichlet Process Mixtures.

http://bcmi.sjtu.edu.cn/∼zihaohu/notes/dirichletprocess.pdf
The Dirichlet process mixtures (aka Infinite GMM) is a powerful tool for Bayesian non-parametrics. There are tremendous documents in the Internet about it, but few of them contain a detailed derivation. I wrote this note for future reference.

Programming Languages

Basic	Intermediate	Advanced
PHP, HTML, MySQL	Python, C/C++, LaTeX	MATLAB, Shell

Interests

Table Tennis, Chinese Chess, Go and Math Puzzles