WEIKANG WANG

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EDUCATIONS

Columbia University *September 2017 - December 2018*
Master of Science, Electrical Engineering
Department of Electrical Engineering

Beihang University *September 2013 - June 2017*
(Former Name: **Beijing University of Aeronautics and Astronautics**)
Bachelor of Engineering, Automation Science (The Outstanding Graduate)
School of Automation Science and Electrical Engineering

PUBLICATIONS

Weikang Wang, Bin Xia, Shangfei Wang, and Enhong Chen. Learning from Macro-expression: an Adversarial Micro-expression Recognition Framework. (Submitted for review)

Wang W., Zhang, B., Qin, R., Yan, Q., Jiang, H. A New VC Dimension Based on Probability. 2016 International Conference on Artificial Intelligence and Computer Science (AICS 2016). ISSN:2475-8841. ISBN: 978-1-60595-411-0. DOI:10.12783/dtcse/aics2016/8239.

Ruoxi Qin, Tian Wang, Haotian Jiang, Qianhong Yan, **Weikang Wang**, and Hichem Snoussi. Cooperative target searching and tracking via uct with probability distribution model. In 2016 IEEE International Conference on Digital Signal Processing (DSP), pages 560-564. IEEE, 2016.

RESEARCH EXPERIENCES

Academic Visiting at Key Laboratory of Computing and Communication Software of Anhui Province (CCSL), Department of Computer Science, University of Science and Technology of China, China
Visiting Student *June 2019 - present*

- **Advisor:** Prof. Shangfei Wang and Prof. Enhong Chen
  Micro-expressions are subtle and brief facial expression thus very hard to recognize. Past works have already used various handcrafted features and deep features in this problem but resulted in poor performances. We adopted an adversarial learning framework that leveraged normal facial expression images, named macro-expressions, to assist the recognition of micro-expressions. We believed that micro-expression and macro-expression with same expression labels could have similar features by proper feature extractor after adversarial learning. Our proposed method outperformed all state-of-the-art method in CAMSE2, SMIC databases and in the composite database task.

Internship at Center for Biometrics and Security Research (CBSR), National Laboratory of Pattern Recognition of China, Institute of Automation, Chinese Academy of Science, China
Research Internship *September 2016 - November 2016*

- **Advisor:** Dr. Stan Li
  I merged Megaface database, MS-Celeb-1M database and CASIA database into one database with images of a same identity merged. This was completed by first adopting a CNN to extract features and then evaluated the similarity matrix of every two features. Pairs with low similarity value below a threshold will be assumed not the same and with high accuracy need to be checked manually. But by adjusting the threshold we can find a balance between the fusion accuracy and the time we need to take and the key is actually how well the features got from the CNN.

A New VC Dimension Based on Probability
Research Student, Beihang University *March 2016 - June 2016*

· **Advisor:** Prof. Baochang Zhang
We considered a new variant of VC dimension by leveraging information from data distribution. Original VC dimension gave a measure of learning ability based on all possible training data distributions, while in many real situations, we only need to concentrate on limited ones. Thus we proposed a new VC dimension which took data distributions into consideration and we proved that the original VC bound was also applicable in our new definition. Thus if we have information of training data, theoretically we can implemented a simpler model to achieve the same performance as the complex model suggested by original VC dimension theory.

Cooperative Target Searching and Tracking via UCT with Probability Distribution Model
Research Student, Beihang University *July 2015 - December 2015*

· **Advisor:** Dr. Tian Wang
We developed an online distributed algorithm used in UAVs tracking and searching, with the consideration of UAVs practical need to recharge under limited power. We propose a Quantum Probability Model to describe the partially observable target positions, and we use Upper Confidence Tree (UCT) algorithm to find out the best searching and tracking route based on this model. We also introduce the Teammate Learning Model to handle the non-stationary problems in distributed reinforcement learning.

COURSE PROJECTS

Is sparse representation a good and profound explanation for face recognition?
Sparse Representation & High Dimensional Geometry, Columbia University *January 2018 - May 2018*

· **Advisor:** Prof. John Wright
I confirmed that the sample space consisting of human face images with different illumination conditions and facial expressions is indeed low-dimensional by calculating the singular values of sample matrix consisting of images from one identity in AR database. By conducting comparison experiments on YaleB databases with area sparsed corruptions, I showed that both collaborative representation and l_1 norm minimization techniques proposed in the Sparse-representation-based algorithm were essential for the performances.

Autonomous driving learning for single-agent problem with deep reinforcement learning methods
Reinforcement Learning, Columbia University *September 2018 - December 2018*

· **Advisor:** Prof. Chong Li
We developed an deep neural network to learn approximate functions of value-action function of autonomous driving problems. The traditional methods for learning value-action function like Q-learning or TD-learning are too space and time consuming thus not practical. We implemented the powerful learning ability of deep network to learn the approximation of the value-action function in order for more efficient autonomous driving systems.

Data Mining Customer Reviews of Hotels
Statistical Learning Theory, Columbia University *January 2018 - May 2018*

· **Advisor:** Prof. Predrag Jelenkovic
We adopted classical machine learning methods including naive Bayes classifer, decision tree and support vector machine to do a regression problem which outputs a rating value based on customer's several inputs. Sensitivity analysis was also conducted in the project. Theoretically analysis offered a clearer and deeper understanding of statistical machine learning tools.

Emotion Detector Machine
Digital Signal Processing *September 2017 - December 2017*

· **Advisor:** Prof. John Wright
We analyzed the recognition ability of facial expressions with different feature extractors including HOG, CNN, and different classifiers, including KNN, SVM. Recognition accuracy comparisons between original features and dimension reduced features by PCA were also analyzed in our project.

Multi-Digits Recognition based on CNN
Neural Network & Deep Learning *September 2017 - December 2017*

· **Advisor:** Prof. Zoran Kostic
We built a CNN can identify length-changed multi-digits in original input images with high accuracy. A mixture probability model is used to represent the length of digits and every identity of those digits. We trained and tested our framework with The Street View House Numbers (SVHN) Database and got a 73.998% testing accuracy.

Face recognition based on deep learning and embedded platform
Undergraduate graduation Thesis *September 2016 - June 2017*

· **Advisor:** Prof. Baochang Zhang
I designed an embedded face recognition system which can capture, preprocess and identify human faces efficiently in an embedded system. Our system combined face image detection, image preprocessing and face identification. The inner structure is VGG19 and fine-tuned to adapt in our problem. We pretrained our network and then encode the framework into an embedded system for recognition tasks. This can be used as sign-in machine by identifying human identities efficiently.

HONORS

The Third Class Prize Scholarship of Beihang University	*2014*
The Second Class Prize of the Chinese Mathematics Competition (CMC)	*2014*
The Second Class Prize Scholarship of Beihang University	*2015*
The Outstanding Graduate of Beihang University	*2017*

SKILLS

Programmings: Python, C, C++, R, Pytorch, TensorFlow.

Mathematical Abilities: Linear Algebra, Matrix Analysis, Calculus, Real Analysis, Complex Analysis, Functional Analysis, Differential Geometry, Probability, Statistical Inference.