Pei Wang

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Education

2017–present **PhD in Machine Learning & Data Science**, *University of California, San Diego*, Advisor: Nuno Vasconcelos, GPA: 3.82/4.00.

2014-2017 **MS in Pattern Recognition & Intelligent System**, *Chinese Academy of Sciences*, Advisor: Weiming Hu Co-advisor: Chunfeng Yuan, GPA: 3.70/4.00.

2010–2014 **BE in Measurement Control Technology & Instrument**, *University of Electronic Science and Technology of China*, GPA: 3.99/4.00 (top 2%).

Research Interests

My research is on trying to explore the powerfulness of self-awareness. A system is self-aware if it can quantify the confidence with which it works. My recent work mainly focuses on employing the self-awareness to solve problems on explainable AI, like counterfactual explanations. I also have research experience on RGB and 3D multi-view action recognition.

Publications

2019 Two papers in submission. One for counterfactual explanations and another for hierarchical taxonomic classification

2019 **Pei Wang**, Nuno Vasconcelos. *Deliberative Explanations: visualizing network insecurities.* The 33rd Conference on Neural Information Processing Systems (**NeurIPS**), 2019

2018 **Pei Wang**, Nuno Vasconcelos. *Towards Realistic Predictors.* The 15th European Conference on Computer Vision (**ECCV**), 2018 (**Oral**)

2018 Weiming Hu, Baoxin Wu, **Pei Wang**, Chunfeng Yuan, Stephen Maybank. *Context-Dependent Random Walk Graph kernels and Tree Pattern Graph Matching Kernels with Application to Action Recognition.* IEEE Transactions on Image Processing (**T-IP**), 2018

2016 **Pei Wang**, Chunfeng Yuan, Weiming Hu, Bing Li, Yanning Zhang. *Graph Based Skeleton Motion Representation and Similarity Measurement for Action Recognition.* The 14th European Conference on Computer Vision (**ECCV**), 2016

2016 Wen Sun, Chunfeng Yuan, **Pei Wang**, Shuang Yang, Weiming Hu. *Hierarchical Bayesian Multiple Kernel Learning Based Feature Fusion for Action Recognition.* The 23rd International Conference on Pattern Recognition (**ICPR Workshop**), 2016

Research Experience

2019.06 - present **Self-aware Discriminant Counterfactual Explanation**, *This work has been submitted to a computer vision conference*.

- Proposed a new family of discriminant explanations. These produce heatmaps that attribute high scores to image regions informative of a classifier prediction but not of a counter class.
- These explanations connect attributive explanations (to explain and visualize why the prediction is A) to counterfactual explanations (to explain and visualize why the prediction is A but not B). The latter are shown to be computable by combination of two discriminant explanations. This make the computation of counterfactual explanations optimization-free and more efficient compared with current optimization based methods.
- Showed self-awareness, namely the ability to produce classification confidence scores, is important for the computation of discriminant explanations, which seek to identify regions where it is easy to discriminate between prediction and counter class.
- A new experimental protocol for quantitative evaluation of counterfactual explanations.
- Outperformed previous methods and substantially faster.

2019.01 - present **Deliberative explanation**, *This work has been accepted by NeurIPS2019*.

- Beyond the simple visualization of the image regions (or, more generally, input variables) responsible for a network prediction, deliberative explanations aim to expose the deliberations carried by the network to arrive at that prediction, by uncovering the insecurities of the network.
- The explanation consists of a list of insecurities, each composed of 1) an image region (more generally, a set of input variables), and 2) an ambiguity formed by the pair of classes responsible for the network uncertainty about the region.
- Proposed a generalized attribution map and showed that most attribution maps previously used in the literature are special cases of ours, based on a first order Taylor expansion and that the high order approximation can lead to more accurate results.
- The resulting insecurities are shown to correlate with regions of attributes shared by different classes. Since these regions are also ambiguous for humans, deliberative explanations are intuitive, suggesting that the deliberative process of modern networks correlates with human reasoning.

2018-present **Towards Realistic Predictors**, *This work has been published on ECCV2018*.

- Current most of machine learning and computer vision algorithms are optimistic. They try to deal with each examples without regard to how hard it is. This is not like our humans do. For human, we have a sense of our limitation. We can do certain things and do them well, but beyond this, we will say 'sorry, I can't do that'. Therefore, we think the classifier should have a rejection mechanism and guarantee a performance in application.
- Defined a new type of classifiers, realistic classifiers, which can reject hard examples so as to guarantee a target good performance on accepted ones.
- Proposed an architecture to implement this new classifier by an adversarial training way.
- Proposed a classifier-specific hardness predictor network to estimate hardness scores for examples.
- Outperformed confidence score, failure predictors based non-realistic classifier by rejecting less examples under every target accuracy.

2015 - 2017 **Graph Kernel Based Method for 3D Human Action Recognition**, *This work has been published on ECCV2016*.

- Constructed a novel semantic graph representation for 3D action recognition.
- Three novelties are given: 1) Proposed a novel low level descriptor based on trajectory segmentation for skeleton sequences; 2) Established graph structures with rich semantic information to represent 3D action sequences; 3) Proposed a novel subgraph-pattern based graph kernel for action recognition.
- Outperformed all state-of-the-art approaches on several public datasets, e.g., MSR Action3D, UTKinect-Action datasets.

2015 - 2017 **Tree Pattern Graph Matching Kernel for Human Action Recognition**, *This work has been published on T-IP*.

- Proposed a novel sub-tree based graph kernel which combined the advantages of graph kernel and graph matching techniques and applied it to human action recognition for monocular videos.
- Two novelties are given: 1) Concise substructure decompositions of the graph kernel which better exploit the local spatio-temporal topology of videos; 2) Removing the incorrect matched pairs in the graph kernel computation leading to dramatic improvement of the discriminative power.
- Outperformed other graph based methods and achieved a comparative performance to the state-of-the-art approaches on several public datasets.

2015 - 2016 **Bayesian Multiple Kernel Learning Based for Action Recognition**, *This work has been published on ICPRW2016*.

- Proposed a new Hierarchical Bayesian Multiple Kernel Learning (HB-MKL) framework to deal with feature fusion problem for action recognition.
- Two novelties are given: 1) Our HB-MKL can learn the optimal combination of multiple features automatically; 2) Automatically learned feature weights provide some insight on how each feature contributes to recognizing an action.

2013 - 2014 **Connectivity-based Parcellation of the Human Primary Sensory Cortex**, *Undergraduate Thesis*.

- Based on diffusion tensor imaging (DTI) and functional connectivity, parcellated the human primary sensory cortex into three subregions.

2018-present **Object Size Estimation from One Single Image**, *UCSD Summer Research Internship Program (collaborate with master graduate students)*.

- To propose a size estimation method for objects from one single image.
- To collect a large-scale image dataset for this task, which includes size, weight, bounding box, mask, depth, material, class information for each object. This dataset can be applied to this task and other related tasks.
- Collected a small-scale dataset and a baseline model has been proposed and tested on it.

Technical Strengths

Computer Languages: C/C++, Matlab, Python

DL Framework: TensorFlow, PyTorch

Professional Service

Conference Reviewer: CVPR, ICCV, ECCV

Journal Reviewer	T-IP, T-SMC: Systems
College Service	TA for ECE271B (Statistical Learning II) on Winter19, ECE271A (Statistical Learning I) on Fall19, UC San Diego

Honors and Awards

2017	ECE Department Fellowship of UCSD
2017	Excellent Students Awards of University of Chinese Academy of Sciences
2014-2016	Graduate Scholarship of University of Chinese Academy of Sciences
2014	Outstanding Graduating Students of University of Electronic Science and Technology of China
2012-2013	National Scholarship (Top 2% among 5000 students)
2012	Fourth-level Certificate for Computer Network Engineer (Highest Level)

Talk

2018	Oral Presentation at ECCV2018, Munich, Germany
2018	Oral Presentation at NRI2018, Washington D.C., United States

Language

Chinese	Native Speaker
English	Fair