Xingjian ZHEN

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RESEARCH INTEREST

Computer Vision, Deep Learning, Statistics, and Medical Imaging

My research interest is about structured data or high-order features in Computer Vision. Since it's quite mature for Euclidean space deep learning, I would like to explore some different structured data or constrained data. The covariance matrices of the feature vectors can be viewed as the second-order features. Those high-order features are constrained by their own structure, i.e., Symmetric Positive Definite. Thus this will break the basic rules in Euclidean space. But those matrices are more robust to noise and contain more high-level information. I want to try some neural networks in Euclidean space, and extend them to those structured data.

EDUCATION

University of Wisconsin-Madison, Madison, WI, U.S. 08/2017-05/2022
Ph.D. Candidate, Department of Computer Science GPA: 3.85/4.0
Advisor: Prof. Vikas Singh
Doctoral Minor: Mathematics

Tsinghua University, Beijing, P.R. China. 08/2013-06/2017
B.E., Department of Electronic Engineering GPA: 90.9/100

PUBLICATIONS

[1] [***AAIC, 2021***] "Altered Structural Connectivity Detected with Dilated Convolutional Neural Network Analysis in the DIAN study and the Wisconsin Registry for Alzheimer's Prevention."
Xingjian Zhen, Rudrasis Chakraborty, Nicholas Vogt, Ruochen Wang, Kao Lee Yang, Nagesh Adluru, Brian Gordon, Tammie Benzinger, Nicole Mckay, Tobey Betthauser, Sterling C, Johnson, Vikas Singh, Barbara B. Bendlin

[2] [***CVPR (Oral), 2021***] "Simpler Certified Radius Maximization by Propagating Covariances."
Xingjian Zhen, Rudrasis Chakraborty, Vikas Singh.

[3] [***AAAI, 2021***] "Flow-based Generative Models for Learning Manifold to Manifold Mappings."
Xingjian Zhen, Rudrasis Chakraborty, Liu Yang, Vikas Singh.

[4] [***CVPR (Oral), 2020***] "CPR-GCN: Conditional Partial-Residual Graph Convolutional Network in Automated Anatomical Labeling of Coronary Arteries."
Xingjian Zhen*, Han Yang*, Ying Chi, Lei Zhang, Xian-Sheng Hua.

[5] [***ICCV, 2019***] "Dilated Convolutional Neural Networks for Sequential Manifold-valued Data."
Xingjian Zhen*, Rudrasis Chakraborty*, Nicholas Vogt, Barbara B. Bendlin, Vikas Singh.

[6] [***AAIC, 2019***] "Sequential Deep Learning Algorithms Show Structural Connectivity Differences By Amyloid Status."
Xingjian Zhen, Rudrasis Chakraborty, Nicholas Vogt, Seong Jae Hwang, Sterling C. Johnson, Barbara B. Bendlin, Vikas Singh.

[7] [***NeurIPS, 2018***] "A Statistical Recurrent Model on the Manifold of Symmetric Positive Definite Matrices."
Rudrasis Chakraborty, **Xingjian Zhen***, Chun-Hao Yang*, Monami Banerjee, Derek Archer, David Vaillancourt, Vikas Singh, Baba C. Vemuri.

UNDER REVIEWING

[8] [***In submission***] "A First Look: Towards Explainable TextVQA Models via Visual and Textual Explanations."
Xingjian Zhen*, Varun Nagaraj Rao*, Karen Hovsepian, Mingwei Shen.

INTERN EXPERIENCE

Amazon, Seattle, WA, U.S. 05/2020-09/2020

Applied Scientist Intern, Product Assurance Risk Security ML Group

Mentor: Karen Hovsepian, and Mingwei Shen

- Built an end-to-end three-mode model to generate answer, textual explanation, and visual saliency explanation with graph neural network and the noise augmentation based on M4C
- Got 1% better accuracy, 7% better textual explanation CIDEr, 2% better visual explanation IoU
- Collected a novel TextVQA-X dataset from public available TextVQA with further explanation
- Wrote paper [8] with oral presentation in the inner conference

DAMO Academy, Alibaba, Beijing, P.R. China. 05/2019-09/2019

Research Intern, Medical AI Algorithm Research Group

Mentor: Ying Chi

- Developed automated anatomical labeling of coronary arteries via CPR-GCN
- Used 3D CNN with BiLSTM to extract the features from the CT images along branches
- Combined both image domain and position information with the partial-residual connection over GCN to achieve 95.8% mean recall, 9% improvement from baseline
- Published paper [4] with oral presentation in CVPR 2020 (5.7% acceptance rate)

RESEARCH EXPERIENCES

Certified Robustness Training via Propergating Gaussian Distribution 01/2020-11/2020

- Applied the certifiable randomized smoothing robustness without sampling with 2× faster
- Proposed a tight estimation of the channel-wise Gaussian distribution to reduce the cost from exponential to linear
- Achieved better certified accuracy and 5% larger certified radius on ImageNet and Places365
- Published paper [2] with oral presentation in CVPR 2021 (4.6% acceptance rate)

Flow-based Generative Model for Non-Euclidean Data 03/2019-12/2019

- Introduced three invertible layers on manifold-valued data whose determinant of Jacobian is simple
- Built the two-stream GLOW that can transfer information from one manifold to another
- Transferred DTI to corresponding ODF with a small reconstruction error and maintaining verifiable group difference with $p-\text{value} < 0.001$
- Published paper [3] in AAAI 2021 (21% acceptance rate)

Manifold Dilated CNN in Group Analysis of Alzheimer's Disease 08/2018-02/2021

- Used TractSeg and Tractometry to compute the average representation along 50 fiber bundles
- Introduced SPD/ S^n manifold into the Dilated CNN model to extract information from DTI/ ODF
- Sped up the training and testing 5× with a competitive number of parameters with SoTA
- Got statistically significant difference on 14 and 16 (out of 50) fiber bundles, by PiB-PET and Gene mutation carriers, on DIAN and WRAP dataset, with total 9 fiber bundles in common
- Published paper [5] in ICCV 2019 (25% acceptance rate), and also extended to [1][6]

Statistical Recurrent Model on the SPD Manifold 01/2018-05/2018

- Defined the "+/ ×" operators in the manifold space using group operators and wFM
- Reduced the number of parameters of the video classification model 100×
- Achieved SoTA accuracy, 78%, on UCF11 dataset
- Published paper [7] in NeurIPS 2018 (21% acceptance rate)

COMPUTER SKILLS

Deep learning framework: PyTorch, TensorFlow, MXNet

Languages: Python, LaTeX, Matlab, C++

REVIEWER SERVICES

2020: ECCV, MICCAI, NeurIPS,

2021: AAAI, ICLR, CVPR, IJCAI, ICML, MICCAI, ICCV, NeurIPS