TAO SUN

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PROFESSIONAL SUMMARY

- A Ph.D. candidate specialized on Speech Enhancement and Source Separation.
- A researcher with solid background in deep learning and machine learning.
- A skilled software developer with multiple years of experience on software development.
- Proven technical ability and collaboration spirit.

Research scientist and multi-faceted software engineer with expertise in:

Speech Enhancement – Source Separation – Deep Learning – Machine Learning
Software Development – Multiple Programming Languages – Technical Leadership

RESEARCH PROJECTS

Integrating Speech Components into Denoising Neural Networks **January 2020 – August 2021**

Integrating human speech components into speech enhancement neural networks has proven to be a simple yet effective strategy to improve denoised speech quality and intelligibility. In this direction, I proposed to rely on self-supervised speech representations to provide guidance for the current denoising neural networks. This approach achieved great success. The output intelligibility of current denoising networks is boosted dramatically.

The similar idea was applied to source separation, and the preliminary results show that the approach is highly effective for the separation tasks.

The publications:

- T. Sun, S. Gong, Z. Wang, C. D. Smith, X. Wang, L. Xu, and J. Liu, "Boosting the intelligibility of speech enhancement networks through self-supervised representations," IEEE International Conference on Machine Learning and Applications (ICMLA), 2021
- T. Sun, S. Gong, Z. Wang, C. D. Smith, X. Wang, L. Xu, and J. Liu, "Boosting the Intelligibility of Time-domain Speech Enhancement Networks through Speech Representations," submitted to IEEE Access

A Smooth Speech Enhancement Solution **January 2019 – September 2019**

In frame-based speech enhancement solutions, the information between adjacent frames is not shared, which inevitably results in boundary discontinuities in the outputs. I successfully solved this frame-stitching problem by supplementing FCNs with RNN modules.

The publication:

- T. Sun, N. Abuhajar, Z. Wang, S. Gong, C. D. Smith, X. Wang, L. Xu, and J. Liu, "Network compression and frame stitching for efficient and robust speech enhancement," IEEE National Aerospace & Electronics Conference (NAECON), 2021

Dilated FCN: Listening Longer to Hear **November 2018 – May 2019**

The capabilities to capture long context and extract multi-scale patterns are crucial to design effective speech enhancement networks. Such capabilities, however, are often in conflict with the goal of maintaining compact

networks to ensure good system generalization. This project explored dilation operations and applied them to FCNs to address this issue. Particularly I proposed the idea that relies on the dilation operations to capture long context for FCN speech enhancement networks.

The publication:

- S. Gong, Z. Wang, T. Sun, Y. Zhang, C. D. Smith, L. Xu, and J. Liu, "Dilated FCN: Listening longer to hear better," in IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA), IEEE, 2019, pp. 254–258

Semantic Segmentation with Capsule Networks **January 2018 – December 2018**

A capsule-based neural network model to solve the semantic segmentation problem was proposed in the project. By taking advantage of the extractable part-whole dependencies available in capsule layers, I derived the probabilities of the class labels for individual capsules through a recursive, layer-by-layer procedure. With the procedure, image-level class labels and object boundaries are jointly sought in an explicit manner, which poses a significant advantage over the state-of-the-art FCN solutions. Although the paper based on this project wasn't among the final acceptance by ICLR2019, reviewers gave positive comments on its work, and the paper gained majority acceptances too among the reviewers.

The publication:

- T. Sun, Z. Wang, C. Smith, and J. Liu, "Trace-back along capsules and its application on semantic segmentation," arXiv preprint arXiv:1901.02920, 2019

PUBLICATIONS

- T. Sun, S. Gong, Z. Wang, C. D. Smith, X. Wang, L. Xu, and J. Liu, "Boosting the intelligibility of speech enhancement networks through self-supervised representations," IEEE International Conference on Machine Learning and Applications (ICMLA), 2021
- T. Sun, S. Gong, Z. Wang, C. D. Smith, X. Wang, L. Xu, and J. Liu, "Boosting the Intelligibility of Time-domain Speech Enhancement Networks through Speech Representations," under review by IEEE Access
- T. Sun, N. Abuhajar, Z. Wang, S. Gong, C. D. Smith, X. Wang, L. Xu, and J. Liu, "Network compression and frame stitching for efficient and robust speech enhancement," IEEE National Aerospace & Electronics Conference (NAECON), 2021
- S. Gong, Z. Wang, T. Sun, Y. Zhang, C. D. Smith, L. Xu, and J. Liu, "Dilated FCN: Listening longer to hear better," in IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA), IEEE, 2019, pp. 254–258
- T. Sun, Z. Wang, C. Smith, and J. Liu, "Trace-back along capsules and its application on semantic segmentation," arXiv preprint arXiv:1901.02920, 2019
- T. Sun, D. Zhu, Z. Yang, Z. Liu, and Y. Liu, "Theoretical predictions of photonic properties of nanoporous copolymer films as photonic band gap materials using FDTD," Applied Physics B, 82(1), 89-92, 2006

RESEARCH ACTIVITIES

Program Committee member and reviewer:

Automation in Machine Learning Workshop (KDD 2021)
Automation in Machine Learning Workshop (KDD 2020)

INDUSTRIAL EXPERIENCE

TECHNICAL LEAD **April 2015 – July 2015**

SAS Institute Inc., Beijing

I led a team developing *SAS BI Dashboard*. My main responsibilities included:

- Working closely with the manager in the US team to understand requirements.
- Planning and documenting technical specifications for features translated from requirements.
- Directing the development team in the design, development and testing applications.

SENIOR SOFTWARE ENGINEER **September 2013 – March 2015**
SAS Institute Inc., Beijing

FormControl, a highly reusable HTML5 component in SAS, was designed to collect user-input values. Based on a data model, it generates various UI controls and organizes them into hierarchical forms.

Strengths and achievements:

- Object-oriented design of *FormControl* to meet general requirements, especially the potential requirement to extend it to *PropertySheet*, a more sophisticated and reusable SAS HTML5 component.
- Designed and implemented some fundamental features of *FormControl*, including but not limited to responsive web solution, data modeling, and binding.
- Fixed most of obstructive bugs.
- Developed other miscellaneous HTML5 components.

The essential supports I provided were crucial to successful releases of *FormControl*. And I was also promoted to a lead position due to my significant contributions to this product.

SOFTWARE ENGINEER **September 2011 – September 2013**
SAS Institute Inc., Beijing

Initially, I was responsible for the plugin developments of *SAS Environment Manager* (EV). Starting from fall 2012, I was appointed as the coordinator for the project of the *SAS Visual Data Builder* (VDB) plugin *File Importer*. Together with other team members, I overcame a series of challenges and ensured high-quality release of VDB. I won the 3C (Collaboration, Communication and Consistency) Award of SAS 2012 due to my great contributions to the project.

Strengths and achievements:

- Rewrote the EV plugin named *Library* and fixed some fatal bugs that deferred the release of EV.
- Set up the prototype of *File Importer* and led the development of it technically.
- Solved a long blocking bug of *Data Spreadsheet*, a component that *File Importer* depended on.

TEAM LEAD AND SOFTWARE ENGINEER **November 2005 – August 2011**
9Spaces, Beijing and Guangzhou, China

- From May 2008 to August 2011, I was leading an outsourcing project, whose owner was one of 9Spaces strategic partners in Seattle. My responsibilities included coordinating design and implementation of applications, collaborating with remote team members to ensure code quality and on-time release of project deliverables.
- Starting from the second half of 2007, I started to lead a team working on *payscale.cn*, Chinese edition of the famous salary survey website *payscale.com*. This project set up payscale.cn with GWT (Google Web Toolkit) and web service. Another key technology used in this project was Heritrix, an open-source web crawler.

- From November 2005 to May 2007, I participated each phase of design and development of *9Spaces.com*. I made significant contributions to component design and implementation, such as internal search engine and a series of interactive UI widget.

EDUCATION & CERTIFICATIONS

Doctor of Philosophy in Computer Science / Ohio University, Athens, OH **September 2016 – April 2022**
GPA: 3.97 of 4.0

Master of Science in Physical Electronics/ Huazhong University of Science and Technology, Wuhan, China **September 2002 – June 2005**

HONORS AND AWARDS

SAS 2012 3C (Collaboration, Communication and Consistency) Award, December 2012

TECHNICAL SKILLS

[Machine Learning and Deep Learning]
• PyTorch, TensorFlow
• NumPy, SciPy
• SpeechBrain toolkit
• CUDA programming

[Programming]
• Python
• Java (Java EE, Spring)
• Javascript (JQuery, Dojo, OpenUI5)

[Software Engineering]
• Object-oriented Analysis and Design (OOAD)
• Project management and agile development (Scrum)