# Shengkun (Bryson) Tang

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**Last Update**: 06.14 2023

## Research Interests

My research interests lie on **Landable Generative Artificial Intelligence**, focusing on the **Resource Efficiency** and **Decision Reliability** of AI System. My research covers the whole pipeline of Generative AI system, providing full-stack solutions from theoretical optimization methods and data-centric strategies to the development of efficient deep learning techniques and the co-design of algorithms and hardware.

1) **Resource-Efficient Training & Inference Algorithms**
2) **Data Optimization to Improve Data Quality & Efficiency**
3) **Reliable & Scalable Methods for AI Systems**
4) **Algorithm-Hardware Co-design for Acceleration**
5) **Application: Multi-Modal (Vision-Language), Uni-Modal (NLP, CV)**

## Education

**North Carolina State University** — Raleigh, USA
Ph.D. in Computer Science — 08. 2023 –
Mentor: Dongkuan Xu

**Wuhan University** — Wuhan, China
B.E. in Remote Sensing and Information Engineering (**Top1** in Asia)
Bachelor — 9. 2018 – 6. 2022
Mentor: Jian Yao

## Publications

**You Need Multiple Exiting: Dynamic Early Exiting for Accelerating Unified Vision Language Model**
**Shengkun Tang**, Yaqing Wang, Zhenglun Kong, Tianchi Zhang, Yao Li, Caiwen Ding, Yanzhi Wang, Ethan Liang, Dongkuan Xu.
**(CVPR 2023)** The IEEE/CVF Conference on Computer Vision and Pattern Recognition

**DDR-Net: Learning Multi-Stage Multi-View Stereo With Dynamic Depth Range**
Puyuan Yi*, **Shengkun Tang***, Jian Yao.
Preprint
(* equal contribution)

**Scale-Robust Deep-Supervision Network for Mapping Building Footprints from High-Resolution Remote Sensing Images**
Haonan Guo, Xin Su, **Shengkun Tang**, Bo Du, Liangpei Zhang
*IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*

## Research Experience

**Efficient Vision Language Model via Early Exiting**

Mentor: Dongkuan Xu (North Caroline State University)
Yaqing Wang (Google Research)

Remote, 5. 2022 – Now

1) Apply early exiting strategy into vision language models to increase the inference speed.
2) Propose modality decomposition to split vision and language information and early exiting in different modalities for different vision language tasks.
3) Utilize Cosine Similarity as metric to decide exiting layers in order to early exit in both encoder and decoder of Seq2Seq model.
4) Our model can reduce 50% computation while 99% performance is preserved and achieves the best trade-off comparing with other methods.

**Efficient Multimodal Learning Software and Hardware Co-design**

Collaborator: Tianchi Zhang (Master in University of Michigan)
Mentor: Dongkuan Xu (North Caroline State University)

Remote, 6. 2022 – Now

1) Aim to optimize software and hardware simultaneously to improve the efficiency of multi-modal model.
2) Utilize input token pruning to shrink input token into static size which is hardware-friendly. The hardware is able to allocate resources in advance and increase the inference speed.

**Research on Multi-View Stereo in Computer Vision and Remote Sensing Laboratory (CVRS Lab)**

Mentor: Professor Jian Yao (Wuhan University)

Wuhan, 6. 2020 – 6. 2022

1) In CVRS Lab, I mainly worked on 3D reconstruction, specifically, multi-view stereo (MVS).
2) Dynamic Depth Range Network (DDR-Net) was proposed in order to solve the issues related to strong-light and textureless scenes and achieved SoTA performance on standard open-source dataset.
3) In this work, I wrote code and did most of the experiments. I still wrote the paper and modified it for several times.

**Synthetic Aperture Radar (SAR) Object Detection and Standard Dataset Construction**

Mentor: Professor Xin Su （Wuhan University)

Wuhan, 9. 2019 – 9.2021

1) Leader of this project.
2) The major task was dataset construction and proposing new model for SAR images which are completely different from optical images.

3) labeled most of the high-resolution SAR images which are hard to image interpretation by eyes. New model targeted on tiny object detection in SAR images.

## Work Experience

**System Developer in Intelligent Automotive Group (IAG), SenseTime**

Shenzhen, 9. 2021 – Now

1) Intelligent Automotive Group builds a large system for self-driving including localization, reconstruction, perception and so on.
2) My work is located at combining all algorithm modules and apply these functions during real scenario. Also, I am required to transfer our system into different platforms such as NVIDIA ORIN and Huawei MDC.

**System Developer in Smart City Group (SCG), SenseTime**

Shenzhen, 5. 2022 – 9. 2022

1) My project in Smart City Group is 3D reconstruction.
2) Build cluster resource manager engine to manage the resource of cluster.
3) Deploy the 3D reconstruction algorithms into clusters and schedule the resources allocated for a specific algorithm.
4) Present a 3D reconstruction algorithm system with high parallelism.

## Internship

**Vision Algorithm Developer Internship in SenseTime**

Shenzhen, 6. 2021 – 10. 2021

1) Two major projects: Chess Robot and Baby Monitor.
2) Deployment of deep learning algorithm. We need to utilize Python to train and evaluate our model for resource-limited devices.
3) Implemented the whole projects in C++ and deploy the algorithm to the specific platform like RockChips.

## Projects

**Automotive Driving System Platform Construction**

Shenzhen, 9.2022 – Now

1) Self-driving is a complicate system which contains localization, prediction, pilot modules and so on. A unified platform is needed to control every module on the real road.
2) The direction of our project is to design a control system that is able to be deployed on real cars. Right now the car deployed our system can self drive without the interaction with humans in highways.

**3D Space Modeling and Rendering**

Shenzhen, 5.2022 – 9.2022

1) This is an official project we worked for China Southern Power Grid company.
2) The task is reconstructing the 3D indoor scenes such as engine room, working areas.

3) The mission of our team is to optimize the reconstruction algorithm in cluster environment. By planning the Dag map, we maximine the degree of parallelism.

**Health Monitor Device: Baby Monitor**

Shenzhen, 6.2021 – 10.2021

1) This project targets on designing a health product to monitor baby status with pure vision images.
2) Propose a novel algorithm to detect breath rate and heart rate with thermal images (close source because of product competition).
3) My work is to deploy all algorithms into edge devices.

**Chinese Chess Robot: SenseRobot**

Shenzhen, 6.2021 – 10.2021

1) The first project during my internship in SenseTime.
2) The goal is to build a human-interactive robot that is able to play Chinese chess with users.
3) Despite pure game algorithm, our robot can also move the chess in the chessboard on own. The robot is selling hot in Jingdong Mall.

## Contests

**Baidu Astar Developer Competition** 2020

Ranking: **7/2305**(teams)
1) The task of Baidu Astar 2020 is traffic signs and surveillance cameras detection and matching.
2) I was in charge of detection task. I solved the problems of long-tail data imbalance by using my own data argumentation strategy and detect surveillance cameras more accurately.
3) We got into the final session and ranked 7 out of 2305teams.

**Mathematical Contest in Modeling** 2020

Prize: S level
1) As team leader, I dispatch the task to my teammates and collaborate with my classmates remotely to finish the modeling task.
2) Analyze the structure of the task and simplify the modeling. The main experiments are conducted based on Matlab.

## Professional Services

**Conference Reviewer**

KDD 2023
AAAI 2023

## Awards

National Endeavor Fellowship Wuhan, 2019
Outstanding student scholarship Wuhan, 2019

## Skills

**Programming**

Python, C/C++, PyTorch, Matlab.
OS: Linux, Mac, Windows.

**Language**

Chinese (Mother tongue), English (Working language)

## References

**Jian Yao, Ph.D.**
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Relationship: Research Advisor during Undergraduate in Wuhan University

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Relationship: Research Advisor during Undergraduate in Wuhan University, Head Teacher

**Yaqing Wang, Ph.D.**
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Google Research
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Relationship: Mentor in Project: Efficient Vision Language Model via Early Exiting