Kenan LI

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EDUCATION

Southern University of Science and Technology(SUSTech)   *Sep 2019 - Jun 2022*
M.S. in Electronic Science & Technology
North China Electric Power University(NCEPU)   *Sep 2015 - Jun 2019*
B.S. in Electrical Engineering & its Automation
Overall GPA: 87/100

EXPERIENCE

Scene Completion Segmentation   March 2023 - now
Group member, supervised by Prof. Feng Chen   *New York University*

Participated in projects about scene completion segmentation.
- Prepared the data set about outdoor scene completion segmentation for SSCBench.
- Prepared the benchmark for voxel-based scene completion segmentation.

Kaggle Data Science Competition (BirdCLEF 2022)   February 2022 - May 2022
Individual Project   *Shenzhen, SUSTech*

Designed and implemented a classification algorithm used densenet121, to classify the bird sound in correct category.
- Processed the bird sound using FFT spectrum and MFCC(Mel Frequency Cepstrum Coefficient).
- Designed the deep learning network based on densenet121 to classify the bird sound in time wise and frequency wise.
- Designed the weight in the loss function to solve the data imbalance problem.

Laser microphone and signal optimization algorithm   July 2020 - September 2021
Group member, supervised by Prof. Hong Xiaoping   *Shenzhen, SUSTech*

Designed and implemented a laser microphone and a filter algorithm based on deep learning.
- Cooperative developed a laser microphone can avoid sound noise perfectly based on the light channel, that hoped to solve the cocktail party problem completely.
- Collected 600 sentences using the laser microphone with 3s interval for each.
- Conceived and developed a neural network, trained on MFCC and time domain of the corpus with around 600 sentences, to complete the information missing vibration signal received on throat skin since it is a partial speaking channel.

Target plant detection algorithm   February 2020 - June 2020
Group member, supervised by Prof. Hong Xiaoping   *Shenzhen, SUSTech*

Made a module of a robot system aiming at making a SLAM in the farmland, detecting the target crop plants and judge its health degree.
- Collected 100 pictures of the maize plant.
- Zooming and rotation were used to expand the data set size.
- VGG-16 neural network is transformed and trained on the data set.
- Achieved accuracy rate to 87% when detected the target plant among grasses.

State evaluation of generator rotor based on machine learning   January 2019 - June 2019
Individual project, supervised by Prof. Li Junqing   *Baoding, NCEPU*

Applied machine learning algorithms with industrial sensor data to make a health state evaluation model about the rotor part of the synchronous generator.

- Analyzed the sensor data sampled from the power plant with visualization.
- Processed the data set using standardized methods.
- Applied empirical theory analysis and principal component analysis to reduce the variables dimension. And selected key variables to represent the health state of the target combined with the heat conduction physical theory and the sensor positions.
- Designed the LSTM(Long and Short Term Memory) neural network based on the time series characteristics of the data set.
- The abnormal state range was delineated in several intervals, centering on the predicted value by the model from historical data. It can be set according to the operation experience in the field.

TEACHING & LEADERSHIP EXPERIENCE

SDM242 Analog and System Design   July 2020 - January 2021
Teaching Asistent   *Shenzhen, SUSTech*

16 weeks conpulsory courses for 33 Undergraduate students.

- Helped professor prepare the lecture needs.
- Made the lab plan, SOP(Standard Operating Procedure) and materials, tutored and answered questions during the lab.
- Collected the assignments, checked their grades and distributed the grades to the students.
- Collaborated to write a grading system program to make the progress easily.

SUSTech Da Vinci Challenge Camp   July - Augest 2019
Coach   *Shenzhen, SUSTech*

Coached the undergraduate students in 5 people group in new engineering education camp for around 40 days.

- Led campers to nursing home to find out the pain point in the olders life, recorded the interview and did the analysis.
- Helped design a product prototype based on the pain point analysis.
- Made a demo product accorinding to the prototype model.
- Helped them did the final presentation to show their idea and product.

Aircraft Club   October 2016 - October 2017
Group Member, Group Leader   *Baoding, NCEPU*

Memeber first and group leader in the end. Aimed at making a fixed-wing aircraft with simple materials like balsa, carbon fiber tube plastic and so on.

- Made sure the airplane can leverage as more water weight as it can and drop the water bottle to the target position. More weight and less displacement from targrt position would get more scores.
- Design and implemented the aircraft using from zero to one, created the communication channel with experienced team in other universities, lead the team to join the competition on behalf of the university in Zhenjiang.
- Although failed in the end. But the experience from a group member to make the group members orgnized for a same goal benefited me a lot.

HONORS & AWARDS

Honors & Scholarship

- 3rd prize, Excellent Teaching Assistant   2021

- Scholarship, Southern University of Science and Technology   **2019**
- Excellent Coach   **2019**
- Outstanding graduates in NCEPU   **2019**
- Siyuan Electric Power Scholarship   **2018**
- 2nd Prize(8%), Scholarship; Merit Student; Outstanding League Cadres; Advanced Individual of Innovation and Entrepreneurship   **2018**
- 2nd Prize(20%), Scholarship; Merit Student; Outstanding League Cadres; Advanced Individual of Innovation and Entrepreneurship   **2017**
- 2nd Prize(20%), Scholarship; Merit Student; Outstanding League Cadres   **2016**

Competition Awards
- Bronze medal(11%), Kaggle Data Science Competition: BirdCLEF 2022   **2022**
- National Class, Rated Excellent, College students' innovation and entrepreneurship training program2018
- Provincial 2nd prize, China Undergraduate Mathematical Contest in Modelling   **2018**
- National 3rd Prize, 2017 China Robot Competition (FIRA Simulation Group, a competition about robot soccer)   **2017**
- Provincial 3rd Prize, The 2nd Hebei provincial college students "Internet Plus": Innervation and Entrepreneurship Competition   **2017**
- National 2nd Prize, Bridge+ (National Youth Business Simulation Contest)   **2016**

TECHNICAL STRENGTHS

Programming languages	C++, Python, R, Java, Javascript, html, C#, SQL
Databases	Microsoft SQL, Redis, MongoDB
Tools	Matlab, Tensorflow, Pytorch, Keras, Anaconda, Pycharm, VSCode, Latex

HOBBIES

Erhu National level five;
Fitness and basketball enthusiasts;

Personal Statement

1 My Motivation

I have a great passion for the research topic of robots and artificial intelligence. My curiosity comes from the robot dream during my middle school period. I thought automation is a promising way to release the pain in people's work and realize more wealthy life. Sensing and intelligent information processing is the crucial ability to realize the real ideal intelligent robot. The deep learning breakthroughs in recent years made me feel it is a great chance to empower the robot with such abilities. I have read Von Neumann's book, *the Computer and the Brain* and Norbert Wiener's *Cybernetics*. The masters' insights inspired me and ignited the fire of passion within me for the exploration of intelligent systems.

During my undergraduate years, my enthusiasm for robotics led me to participate actively in robot-related clubs and competitions. These extracurricular experiences offered a platform to expand my knowledge beyond the classroom. When I was in my master's program at SUSTech, I seized every opportunity to deepen my understanding of artificial intelligence. I audited courses from both the computer science and biomedical engineering departments, diving into topics like Machine Learning, Advanced AI, and BI&AI. Additionally, I gained invaluable exposure to advanced research projects in my supervisor's lab.

2 Research in Robotics Sensing

My research journey through robotics sensing and artificial intelligence has been marked by several projects that have honed my engineering skills and expanded my horizons.

2.1 Robotics Vision

During my undergraduate program, due to my great passion for robots, I have taken part in many robots-related competitions and clubs and luckily got some rewards.

In my sophomore year, I partook in a **intelligent car model competition** with 2 partners. During the process, we designed a car model which could use a camera to guide itself to run along the track. I designed and welded the PCB to arrange the power and computing modules, and coded on the chip K60. The program could process frames captured by the camera, extract out edges of the road, regard the offset between the centers of the road and the camera's FOV as an error, then give it as feedback to change the wheels' velocity to keep the car always run on the road. In the end, it turned out we obtained an excellent result and got an award in the competition as the top 20. This experience gave me a whole view of how to integrate vision into robot control systems, which also helped me got the national third prize in a **robot soccer competition**, in which I designed and implemented the defense plan for my team.

The graph signal processing experience also helped me to accomplish another **mathematical modeling competition** in my junior year, I and my partners together analyzed the CT data of the human body tissue and reconstructed the image from the scanned residual radiation data with the adapted Radon Transformation method. And finally designed the shape of a calibration object for semicircular scanning (normal scan is over 180°). We got an award as top 30%.

When I entered my master's program, I learned more advanced robot vision algorithms like deep learning, etc. Thus, in a project, my team constructed a **field agriculture robot** used for distinguishing weeds from crops. The main contribution that I made was to construct a classification module. I collected pictures of weeds and maize seedlings, labeled them, and then tuned the VGG-Net to classify them. At last, this algorithm yielded an accuracy of 87% in the final test.

And from this project, I know SLAM (Simultaneous Localization and Mapping), which guided our robot to move using robot vision. But a problem is becoming obvious, as the data quality from sensors becomes higher, the data volume also goes wildly, thus the SLAM needs an efficient data querying mechanism. So we conducted another project, **SLAMDB** (Simultaneous Localization and Mapping Database), I designed a database framework to improve the storage resource usage efficiency of the SLAM algorithm. The classical SLAM algorithms all ran in memory, leads the limited memory on the mobile device being heavily loaded while the disk was rarely used. Thus, the database could be introduced to overcome some limitations. Given that SLAM tasks concerned time series, the in-memory database Redis was chosen to make a rotation query structure to store the data. The framework experimented on the ORB-SLAM2. The approach allowed SLAM to execute long sequences without memory overflows.

While doing these projects, I become interested in segmentation tasks in computer vision. It is a hot topic recently because of its big achievement using deep learning based algorithms. Humans can segment the object as we want easily, but even the most advanced algorithm can not handle it well as human beings, it is regarded as a part of the Real Intelligence, I have a big passion to dig into it more deeply. And I was lucky to work in AI4CE lab, New York University, supervised by Prof. Feng Chen. I have prepared a data set for the semantic scene completion benchmark, which offers more diverse data in the outdoor scenarios for related task tests. I co-authored a research paper named **SSCBech** on NeurIPS, which is on review now. And I am also conducting another segmentation related research task, which also gives me more insight on the ultimate problem.

2.2 Robotics Hearing

During my master's program, I have also done some interesting projects about robot hearing in the ISEE lab, since hearing is also a vital channel for perceiving environmental information apart from vision. Humans can only hear sound through air vibration, however, robots can be flexible in the same condition, like the optical channel with laser. And the laser can also help collect clear target sounds in a noisy environment easily, while humans can only rely on forced focusing attention.

So we conducted a project named **REAL** (Robot Ear According Laser) with my partners under my supervisor's guidance. During the process, I assisted to construct hardware and explored relevant signal extraction algorithms. Regarding the hardware module, it is an optical experiment platform with a laser and lens system on it. The laser reflected from the sound source was sampled, going through analog lowpass filters and amplifiers and finally joining in the DAQ device. These vibration signals were collected by LABVIEW as files, and then they were converted to audio files after being denoised by some basic filter algorithms like Moving Average Filter in MATLAB. The original voice was also collected as the ground truth, available for training the deep learning algorithm to increase the SNR. Some basic audio signals processing methods like FFT and MFCC were utilized for visualizing the audio signals and training the neural network. Moreover, spectral subtraction was adopted to remove noise in signals where the no-signal background noise intervals were processed as the minuend. The neural network was adapted from google VoiceFilter. In the end, I co-authored a device patent and finished a journal article on *Advanced Intelligent Systems*.

After learning the acoustic signal processing algorithm that I mentioned before, I indulged myself in attending a **Kaggle** competition, in which I built a classification model based on the Densenet121 as a backbone to identify birds' species by their sound records, and finally got a bronze medal as the top.

3 Research Interests

My zeal for robotics and computer vision propels me to pursue advanced research in these fields. I am eager to delve deeper into cutting-edge challenges. My previous experiences have equipped me with the skills and motivation to contribute meaningfully to the ongoing advancements in related domains.