Kasra Davoodi

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RESEARCH INTERESTS

Artificial Intelligence, Computer Vision, Biomedical Signals, Data Science, Embedded Systems, Wearable Devices
Autonomous Driving

EDUCATION

K. N. Toosi University of Technology

Tehran, Iran
2020 – present

B. Sc. in Electrical Engineering,
GPA: A+ (3.84/4 - TOP 6% of my entrance)
GPA: A+ (3.89/4 - Top 3% of my entrance – last 2 years)
Bachelor Project: "Segmentation & Classification of ICH in Brain CT Scan via Deep Learning"
Supervisor: Prof. Amirhossein Nikoofard

RESEARCH EXPERIENCE

K. N. Toosi University of Technology

Tehran, Iran
October 2023 - present

Research Assistant (with Prof. Amirhossein Nikoofard, at APAC research group)

• **Project Name**: Classification and Segmentation of ICH in Brain CT scan. (teamwork)
• Literature review of around 80 articles using Google Scholar. (teamwork)
• Hyper-parameter tuning via a grid search based on dataset characteristics and output metrics trend. (teamwork)
• Hugging Face and Segment models Pytorch (SMP) are used as platforms for pre-trained models. Good to mention, most trainings were done on Google Colab. (teamwork)
• Negotiating with Physicians to collect a solid balanced Brain CT scan dataset. (teamwork)
• Conduct weekly meetings and continuously track work progress with other team members of the project. (teamwork)
• Writing assistance for other academic articles in similar fields as a side work. (solo)

K. N. Toosi University of Technology

Tehran, Iran
Jan 2023 - Sep 2023
Aug 2024 - Present

Research Assistant (with Prof. Hossein Hosseini-Nejad, at Zistel company)

• **Project Name:** Improvement of pulse oximeter in precision and reliability.
• Learned to code in MATLAB and STM32 micro-controller to design a new signal processing algorithm and Implement it on STM32 & nRF. (solo)
• Literature review on different peaks and valleys detection methods in PPG signal. (solo)
• Data collection (PPG signal) from different hospitals to create a private dataset for all projects related to this signal. (teamwork)
• Development of an innovative lightweight signal processing algorithm for peaks and valleys detection in MATLAB application. (solo)
• Implementing my algorithm on Zistel's commercial pulse oximeter with two microcontrollers.
• Study the hardware modules of the pulse oximeter to smooth the connection between my software and the hardware.
• Developing multiple machine learning approaches (SVM, XGBoost, KNN, DT) on PPG signals to classify stress and non-stress signals. (teamwork)

Technical & Research SKILLS

Programming skill	Artificial Intelligence	Embedded systems	Research Skills
Python, C, C++, Matlab	ML, DL, Computer Vision	STM32, nRF, AVR	Literature Review
NumPy, Pandas, SQL	Grid Search, Tuning	Digital Signal Processing	Team Work
QT, Cube MX, Code Vision	PyTorch, TensorFlow, Hugging Face	Algorithm Development	Writing (LaTeX)
HTML, CSS	Data Analysis	Proteus	Documentation

TEACHING EXPERIENCE

- **Head TA** for "Fundamental of Computer Programming." Fall, 2024
  K. N. Toosi University of Technology, **Prof**. Behrooz Nasihatkon
  team leader, course project design, code lab design, management

- **TA** for "**Fundamentals of Computer Vision**." Spring, 2024
  K. N. Toosi University of Technology, **Prof**. Behrooz Nasihatkon
  code labs grading, course project design, code lab design
  course page

- **Head TA** for "**Electronics 1**." Fall, 2024
  K. N. Toosi University of Technology, **Prof.** Amir Masoud Sodagar
  management, grading, hybrid problem-solving classes, quiz and homework preparation

- **Co-Head TA** for "**Electronics 2**." spring, 2023
  K. N. Toosi University of Technology, **Prof.** Ebrahim Nadimi
  management, grading, hybrid problem-solving classes, quiz and homework preparation

- **TA** for "**Electronics 1**." Fall, 2022
  K. N. Toosi University of Technology, **Prof**. Amir Masoud Sodagar
  grading, online problem solving

- **TA** for "**Fundamentals of Computer Programming**." Spring, 2022
  K. N. Toosi University of Technology, **Prof.** Hamed Khanmirza
  grading, online problem solving, course material preparation, course project manager

PUBLICATIONS

Conference papers

1. Mohammad Hoseyni, Kasra Davoodi¸ Fatemeh Pakdaman, Mahdi Aliyari shoorehdeli, Amirhossein Nikoofard*, "Comprehensive Hyperparameter Tuning to Enhance Deep Learning Performance for Intracranial Hemorrhage Classification in Head CT Scans" *Int. Conf. Biomedical Engineering. (ICBME)*, Tehran, Iran. (**accepted, oral presentation in December**), June 2024

Journal papers

2. Zahra Ghafari, Kasra Davoodi¸ Danial Katoozian, Hossein Hosseini-Nejad*, "An Innovative Approach for Beat Detection and Quality Assessment in PPG Signals", (**under review**)

3. Zahra Hasani, Maryam Mahdavimoghdam, Razieh Mohammadi, Zahra Shirmohammadi, Amirhossein Nikofard*, Eesa Nikahd, Kasra Davoodi, "Deep Reinforcement Learning-based Mechanism to Improve the Throughput of WSNs", (**under review**)

4. Mohammad Hosseini, Kasra Davoodi, Fatemeh Pakdaman, Amirhossein Nikofard*, "Advanced Classification and Segmentation of ICH in Brain CT Scans via Using a Two-Step Deep Learning Approach and Fuzzy Decision Policy", (**in preparation**)

NOTE: I was not involved in the R&D of 3rd paper. I just helped them with writing revisions and improving the clarity of the text.

PROJECTS

Biomedical Engineering:

• Segmentation of ICH Brain CT Scan via Deep Learning.
Objective: Segmenting ICH lesions in Brain CT scans to be used as an assistant for physicians in medical centers. We are working on a two-step procedure that consists of a CNN model and a sequential model in series (Via PyTorch). This project is in the R&D Phase with the collaboration of Iran Medical University.

• Classification of ICH Brain CT Scan via deep learning.
Objective: Classifying Brain CT scan patients and slices in two classes of Healthy/ICH. We implemented a **ResNet50** model with preprocessing, augmentation, weighted BCE loss, 5-fold, and a voting decision policy. (Via PyTorch)
Results:
patient-level scope: Sensitivity = 1.00, specificity = 0.80, F1 score = 0.86, accuracy = 0.88
slice-level scope: sensitivity = 0.94, specificity = 0.91, F1 score = 0.64, accuracy = 0.91
(December 2023 – June 2024, **Accepted Paper, ICBME 2024**)

• Stress detection for wearable devices using PPG signal.
Objective: creating a stress detection method for pulse oximeter of Zistel company. Firstly, we are working on a binary classification. After that, we have aimed for multi-class classification. We implemented a **two-step preprocessing** approach consisting of peak/valley detection and an XGBoost model for quality assessment, before the main ML model.

• Heart rate & SPO2 calculation for pulse oximeter of Zistel company.
Objective: Design a lightweight and precise algorithm for detecting peaks and valleys. I designed a 4 step procedure that loops through the signal: 1) Setting adaptive threshold, peak / valley detection, double check, variable update. This algorithm was later used in the stress detection project.
Results: Sensitivity = 99.32%, Positive Predictive = 99.52%, F1-score = 99.43%

Autonomous Driving:

• Vehicle and human live detection
Objective: detecting vehicles and humans from 6 visible. I used **YOLOV8s** with preprocessing and augmentation for this project due to its speed, performance, and time limitations.
Results: F1-Score: 87%, Recall: 84%, Precision:90%, mAP50: 90%, mAP50-95: 68%

• License plate recognition.
Objective: A 6-step educational course project that we designed for computer vision class as TAs. We aimed to familiarize students with different deep learning project aspects

NOTE: I Strongly Encourage You to Explore my Webpage for Further Technical Details of Above Projects. Information such as Client, Date, and Technical Backbone are Available on My Webpage.

Course Projects:

• Designing an **AM modulator with Gilbert circuit** using Altium Designer. In addition, we printed the PCB and assembled it in our university's electronic lab. (May 2024 – Electronics 3 Laboratory)

• Detecting chess pieces in a chessboard to map their arrangement to a digital Image of the chessboard through 4 steps by designing a **CNN** and using the **YOLOv5** model.
(May 2023 – Fundamentals of Computer Vision)

• Car Interior light controller via coding **atmega64**. It contained multiple situations based on user input and time. Did the simulation in **Proteus**. (May 2023 – Digital Systems 2)

• Designing a four-state counter based on **Gray** and **Excess-3 codes** and showing it via two 7-segments. It contained multiple configurations based on a 4-bit input. (December 2022 – Digital Systems 1)

• Designing a multi-stage **amplifier** for turning on an LED just by fingertip current**.** It was first simulated in PSpice and then implemented in breadboard **(** May 2022 – Electronics 1)

INDUSTRY EXPERIENCE

Parto Dadeh Company   Tehran, Iran
- Internship, learning **C++** and **QT framework**.   June 2022 – October 2022
- Focusing on **object-oriented programming** in application designing.
- Involved in designing both **GUI** and **backend** for a telecommunication device used in fire stations and airports.
- Got familiar with the industry atmosphere.
- Learned basics for 2 months, after that, I Worked there for 3 months as a **full-time intern**.
- Dramatic Improvement in my understanding of programming.

CERTIFICATES

Deep Learning Course and Project (128 hours - Neuromatch Academy – July 2024) View Credential

LANGUAGE PROFICIENCY

English: **IELTS Score = 8.0** (Listening = 9, speaking = 7.5, Reading = 8.5, writing = 7). click for report form

Persian: Native

VOLUNTARY WORKS

Manager of Education Section in IEEE KNTU Student Branch

I undertook a variety of tasks as the manager of this section. Due to my impressive performance and prolific record through my one-year duty, I received a certification of appreciation from the counselor of the IEEE student branch (Dr. Nosrat Granpayeh) and the chairman of the IEEE KNTU student branch. As a leader, I created a dedicated and precise team. We conducted multiple workshops, online courses, webinars, and seminars. We were concerned about selling courses which were necessary and useful. I'm proud to say that our efforts not only enhanced the skills and knowledge of many students but also created about 10 part-time job opportunities for graduate students as instructors in various courses. In addition to technical courses, multiple webinars and seminars were conducted by experts to spread awareness about soft skills among undergraduate students.

HIGH SCHOOL HONORS

- **GPA = 4** (final year)
- **Ranked top 0.9%** (among 155000 students) in the **National Undergraduate Entrance Exam** in Mathematics,2020
- **Ranked top 1.1%** (among 174000 students) in the **National Undergraduate Entrance Exam** in foreign languages,2020
- Ranked 7, 9, and 10 (among 15000, 20000, and 15000 students respectively) in Gozine2 (a popular national educational exam in Iran). 2018 – 2019
- Accepted in the first round of the **national student's Olympiad** in mathematics, computer, physics (2 times), and astronomy, 2018 – 2019
- Accepted in the first round of the **International Mathematics Competition** (IMC) for 2 times. 2018 – 2019
- Champion of our school's football competition. 2019
- Ranked 60, 55, and 21 in three categories of the Rubik's Cube national competition (Iran Open). 2016
- Named as the most profitable salesman at the **student sales competition** of our school. 2016