Kasra Davoodi

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RESEARCH INTERESTS

Artificial Intelligence, Computer Vision, data science, Biomedical Image processing, Biomedical Signals, Embedded systems, wearable devices, Digital Signal Processing, Autonomous Vehicles, Finance

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
Research Assistant (with Prof. Amirhossein Nikoofard, at APAC lab) — October 2023 - present

- **Project Name**: Classification and Segmentation of ICH in Brain CT scan. (teamwork)
- Literature review of around 80 valuable articles published in this field using Google Scholar. (teamwork)
- Hyper-parameter tuning to enhance the performance of our deep learning model (UNet) via a grid search based on dataset characteristics and output metrics trend. (teamwork)
- Research and analysis of different deep learning architectures to find a suitable deep learning model for our application. (solo)
- Using Hugging Face and Segment models Pytorch (SMP) 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)
- Conducting weekly meetings and continuous tracking of work progress with other team members of the project. (teamwork)
- Writing assistance for other academic articles in the similar fields as a side work. (solo)

K. N. Toosi University of Technology — Tehran, Iran
Research Assistant (with Prof. Hossein Hosseini-Nejad, at Zistel company) — January 2023 - September 2023, August 2024 - Present

- **Project Name:** Improvement of pulse oximeter in both terms of precision and reliability.
- Learned to code in MATLAB and STM32 micro-controller in order to design a new signal processing algorithm and Implementing it after that. (team work)
- Literature review on different peaks and valleys detection methods in PPG signal. (solo)
- Data collection (PPG signal) from different hospitals in order to create a private dataset for all projects related to this signal. (solo)
- Development of an innovative lightweight signal processing algorithm for peaks and valleys detection in MATLAB application. (solo)
- Implementing my algorithm on the Zistel's commercial pulse oximeter with two different micro controllers, nRF and STM32. (solo)
- Got familiar with hardware modules of the device like memory and light sensor in order to debug its reliability and speed problems.
- Developing multiple machine learning approaches (SVM, XGBoost, KNN, DT) on PPG signal in order to classify between stress and non-stress signals. (team work)

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	Digital Signal Processing	Team Work
QT, Cube MX, Code Vision	PyTorch, TensorFlow, Hugging Face	Algorithm Development	Writing (LaTeX)
HTML, CSS	Big Data	Proteus, PsPice	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*, "Improvement of Stress Detection featuring a machine learning approach and an innovative preprocessing", (**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 consisted of peak/valley detection and a XGBoost model for quality assessment, before the main ML model.

• **Heart rate & SPO2 calculation for pulse oximeter of Zistel company.**
Objective: designing 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 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 trough 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 **Amplifire** for turning on a LED just by fingertips current**.** It was first simulated in PSpice and then implemented in bread board **(** 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 tele communication device used in fire stations and airports.
- Got familiar with industry atmosphere.
- Learned basics for 2 months, after that I Worked there 3 months as a **full-time intern**.
- Dramatic Improvement in my understandings of programming.

CERTIFICATES

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

LANGUAGE PROFICIENCY

English: Fluent

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 form the counselor of IEEE student branch (Dr. Nosrat Granpayeh) and the chairman of 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 in order to spread awareness about soft skills among students.

HIGH SCHOOL HONORS

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