Bruce (Shouyue) Hu

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SKILLS

Programming Languages: Python(work experience), C/C++, Bash, Matlab, Java, JavaScript
Libraries/Frameworks: PyTorch, Tensorflow, OpenCV, Scikit-learn, Matplotlib, Threading, XGBoost
Tools: ROS(work experience), Git(work experience), Docker, AWS EC2, GCP

EDUCATION

Bachelor of Computing (Science, Honours)   Sep. 2018 – Jun. 2022
Queen's University, Kingston, ON, Canada
Artificial Intelligence Specialization
Minor in Mathematics
cGPA 3.8/4.3, third/fourth year GPA: 3.9/4.3
graduated with distinction
Course taken: Reinforcement learning , Artificial Intelligence, Non/Linear Analysis, Robotics…

ACADEMIC

Text Dataset and Classification   Jun. 2024 – Present
Wharton Research Data Services, USA
- Creating an open-source structured question-answer text dataset by processing transcripts of 103k texts
- Processing text by vectorization (NLTK, Hugging Face/BERT, TF-IDF), dimension reduction (PCA, t-SNE, UMAP), and clustering (K-Means, cosine similarity)
- Designing a method that automatically labels text, based on definitions of labels, achieving ~76% accuracy compared to manual annotation

Research Assistant *[Link]*   Feb. 2023 – Aug. 2023
Supervisor: Dr. David St-Onge, Part-time, École de technologie supérieure, Canada
- The project aimed to assess drone operators' cognitive loads by monitoring their physical data
- Integrated data from sensors including IMU, cameras, microphones, and pupil trackers
- Implemented and experimented with filters, interpolation methods, and data visualization
- Proposed a efficient real-time blink detection method (embedded 50Hz) and audio classification CNN
- Collaborated with other researchers for timestamp synchronization among different devices
- Assisted mechanical engineering students with coding and network configuration; presented project demonstrations to lab visitors

Undergraduate Research *[Link]*   Sep. 2021 – Apr. 2022
Adviser: Dr. Ting Hu, Queen's University, Canada
- Created a novel melody generator using an Evolutionary Algorithm that extracts, combines, and iterates features based on user selections

PROFESSIONAL

Research Developer   Jan. 2023 – Mar. 2024
Supervisor: Dr. Jayson Bursill, Full-time, Delta Controls Inc., Canada
- Developed web-based services for industrial automation
- Built REST APIs in Python, designed interfaces using JavaScript integrated with PostgreSQL database
- Developed webs for data visualization and spreadsheet editing with auto-complete feature
- Diagnosed inefficiencies in an existing queue function and developed a concurrent processing mechanism, reducing request times by 58% for a queue size of ~6000
- Developed a Q&A agent to simplify administration tasks leveraging large language models

Robotics Engineer   Jul. 2021 – Aug. 2021
Internship, R&D, Shuangyuan Optoelectronics Tech Co., Ltd., China
- Developed a vision-aimed robotic arm system that performs pick-place tasks for industrial automation
- Designed a object detection algorithm, utilizing dynamic project lights and fusing bright pixels from multiple images, based on the roughness difference between the objects and desktop surface
- Engineered calibration (matrix), segmentation (smooth filter, Sobel operator), edge detection (Morphological and Hough Transformations), and edge clustering (K-Means)
- Handled signals via Modbus/USB, developed multi-tread control software for sensors and actuators
- Designed navigation trackers and calibration methods using affine transformation; fine-tuned PID
- Achieved repeatability of 0.15 mm with 5 DoF

AWARDS

- Queen's Excel Scholarship 2018
- Dean's Honour List 2018 - 2022
- Academic All-Star (Fencing Athlete) 2018 - 2022

SELECTED PROJECTS

Realtime Hand Gesture Classification using ResNet *[Link]*   Jun. 2024
- Adjusted ResNet structure for time-series data of SHREC 2021 Gesture Benchmark
- Applied weight decay, tuned hyper-parameters, added a learning rate scheduler, and adjusted model size
- Achieved 93% validation accuracy and addressed overfitting
- Wrote a report the analyzes and compares online and offline detection methods

Task Planner   Jun. 2024
- Developed parallel PyTorch scripts for multiple GPUs on a remote headless server
- Developed a text-based task planner by selecting from an atomic action list leveraging GPT-4's assistant features, function-call, and JSON dataflow

Q&A Agent leveraging LLMs   Nov. 2023 – Feb. 2024
- Built an agent that automates information retrieval to reduce personnel requirements on customers
- Engineered GPT3.5/4 API, investigated GPT2 fine-tuning, Llama2 quantization, and RoBERTa
- Integrated middleware with company databases to enable retrieval-augmented generation (RAG)
- The agent can read past data given a range, execute linear regression, and generate reports in PDF

Pupil Diameter Processing and Blink Detection *[Link]*   Feb. 2023 – Aug. 2023
- Created an efficient live blink online detection algorithm that takes pupil diameter signal as input
- Achieved $O(n)$ time complexity and $O(1)$ space complexity using dynamic programming, and it is runnable on embedded devices
- Reproduced data interpolation methods when the sensor lost track of pupils during blinks

Audio Cognitive Load Classification *[Link]*   Jul. 2023
- Reproduced and adjusted a CNN for cognitive load classification on audio
- Preprocessed audio data, converted waveform to spectrograms, and trained model using PyTorch on the AVCAffe dataset with GPU on Google Cloud virtual machines

Stable Diffusion Textual Inversion *[Link]*   Mar. 2023 – Apr. 2023
- Tuned a generative model that simulates my art style by training an extra embedding for CLIP model

Tree-based Model for Data Matching *[Link]*   Jun. 2022 – Jul. 2022
- Implemented fuzzy matching to resolve data duplication with similar semantic information
- Cleaned a dataset of 11 features, augmented data pairs by combinations
- Calculated semantic similarity of information using BERT and cosine, calculated geographical distance based on location name and latitude & longitude
- Employed XGBClassifier as a decision tree for semantic similarity and geographical distance
- Achieved 86% accuracy

Dog Bot in a Simulation Environment *[Link]*   Nov. 2022
- Built settings for geometry, collision box, inertia, joint transfer, and camera node for a dog robot
- Learned ROS Gazebo simulation and XML Robot Description Format (URDF)

Spider Robot on RaspberryPi *[Link]*   Jun. 2021 – Sep. 2021
- Built a hexapod including mechanism, power supply, control software, and data pipes
- Learned, designed, and welded the circuit including voltage transformers for actuators and motherboard
- Modified 3D models, and contacted a 3D printing vendor to produce the components
- Manipulated spider walking motion for 16 motors by back stepping the transformation matrix

Reinforcement Learning in a Physics Simulation Environment *[Link]*   Apr. 2021
- Implemented Q-learning for the cart-pole problem, converted action space from continuous to discrete
- Improved policy structure for multi-tasking
- Simulated 2D physics using OpenAI/gym

Path Searching Using Evolutionary Algorithm *[Link]*   Apr. 2021
- Created a path-searching algorithm for grid maps using stochastic optimization
- Designed loop closure detection, and diversity maintenance
- Evaluated performance in maps with different resolutions and compared to classic methods