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PRE-PRINTS

Iris and Palmprint Multimodal Biometric Recognition using Novel Preactivated Inverted ResNet and Hybrid Metaheuristic Optimized DenseNet
Indu Singh, **Gunbir Singh Baveja**, Shruti Khatri, Sunaina Luthra, and Tanvi Singh
IEEE Transactions on Machine Learning in Communications and Networking

WORK EXPERIENCE

Deep Learning Researcher   **September 2024 - Present**
UBC Multifaceted Innovation in NeuroTechnology (MINT)   *Vancouver, BC*

- Designed and implemented neural network architectures to control Mujoco-simulated legged robots for directional movement guided by neural signals.
- Collaborated with a multidisciplinary team to integrate deep learning models with neural decoding algorithms, enabling mind-controlled robot navigation.
- Developed and optimized reinforcement learning algorithms for humanoid locomotion based on open source repository LearningHumanoidWalking.

Visiting Student Researcher   **June 2024 - August 2024**
Korea Advanced Institute of Science and Technology   *Seoul, Korea*

- Worked on a literature review of continual reinforcement learning, and re-implemented papers on the intersection of passive non-stationarity and active Markov Games.
- Advisor: Joseph J. Lim, Department of Computer Science

Software Team Lead, Fast.ai, PyTorch, Arduino, Python   **November 2023 - Present**
Open Robotics   *Remote*

- Leading a six-member software team for the Pianobot project.
- Directed the development of the MIDI and Arduino translators.
- Implementing Reinforcement Learning (RL) algorithms to optimize for technical efficiencies and working towards more autonomous behavior of the robot – allowing for real-time improvisation.

Research Intern, PyTorch, OpenCV, Matplotlib,   **June 2023 - August 2023**
Delhi Technological University   *Delhi, India*

- Under the supervision of Dr. Indu Singh: formulated, designed and implemented a novel two-fold multimodal recognition architecture with histogram equalization with FALF-SVR, a pre-activated Inv-ResNet block with spatial attention and global-local JFPA-ROA search-matching.

Machine Learning Intern, TensorFlow, OpenCV, MongoDB, Python   **April 2020 - July 2020**
Bausch + Lomb   *Remote*

- Implemented data augmentation techniques to diversify and expand the training dataset.
- Utilized incremental learning methodologies for continuous improvement of the model over time and developed a large-scale model that demonstrated enhanced accuracy in predicting stock levels.

PROJECTS

Continual Diffusion: Exploration and Adaptation in Non-Stationary Tasks   **March 2024**
https://github.com/sheeerio/continual-diffusion

- Designed and implemented diffusion models for reinforcement learning in non-stationary, vision-based tasks.
- Developed and trained Diffusion Policies using a denoising diffusion probabilistic model (DDPM) for dynamic environments.
- Achieved superior performance compared to SOTA algorithms like PPO and DQN in Procgen and D4RL environments.
- Evaluated the framework across challenging tasks like CoinRun, Maze, and PointMaze, demonstrating robustness and adaptability.

Data-Efficient Exploration with Self Play in Open-ended environments   April 2024

- Implemented Provable Self-Play Algorithms for Competitive Reinforcement Learning in PyTorch.
- Compared our method with SOTAs such as SelfPlayer, GoExplore, Curiosity, PPO, Rainbow, SimPLe.
- Demonstrated the sample-efficiency of VI-ULCB, proving the algorithm to be robust for open-ended problems.

Schizospeak: An Esoteric Programming Language   July 2023

http://npmjs.com/package/schizospeak

- Developed Parser, a Lexer, and Interpreter using TypeScript and incorporated expressions, declarations, identifiers, and literals types.
- Implemented self-recursive code and depth-first search algorithm to solve logical lexical morphology of the language.
- Created the language to support Expressions: assignment, binary, call, and member expressions; Declarations: variable, function, if, and for declarations; and Literals: numeric, string, and object literals.

Alokhe   February 2022

https://github.com/sheeerio/alokhe

- Developed symbolic code in Python to perfectly transliterate from English to Hindi using phonosyntactic rules of linguistics.
- Used flask to create and host a REST API for Alokhe.
- Created a discord bot using JavaScript that used Alokhe API and OpenAI API with the ability to transliterate English to Hindi and Hinglish (Hindi written in the alphabet) to Hindi.

AutoTechnoblade   November 2020

https://socialblade.com/twitter/user/autotechnoblade

- Fine-tuned GPT-2 on Technoblade's tweets using few-shot learning.
- Created a Twitter bot using Python and JavaScript.

PRESENTATIONS

Scalable Unsupervised RL with Metric-Aware Abstraction   June 2024
KAIST · Reinforcement Learning Reading Group

Skill-based Model-based Reinforcement Learning   March 2024
KAIST · Cognitive Learning for Vision and Robotics Group

AWARDS AND GRANTS

- **International Work Terms Grant:** UBC Vancouver Co-Op ($1,000)
- **Outstanding International Student Award:** UBC Vancouver ($10,000)
- **Second Award, Global Youth Science and Technology Bowl:** independent project. Awarded by The Hong Kong Federation of Youth Groups.
- **Grand Award, IRIS National Fair:** Selected amongst around 1000 teams to represent India at the Intel Science and Engineering Fair. Awarded by the Ministry of Science and Technology of India.
- **Finalist, Intel Science and Engineering Fair.** Represented India for my research at the largest science fair in the world.
- **Most Outstanding Exhibition in STEM, IRIS National Fair:** awarded by Yale Science and Engineering Association at the IRIS National Fair.
- **Bronze Medal, Asia Pacific Linguistics Olympiad (APLO):** selected as member of alternate team for India at the International Linguistics Olympiad (IOL) 2022. *APLO Rank 8, PLO Rank 11.*
- **Top 10 Leaderboard, NeurIPS Concordia Challenge:** Developed cooperative AI agents in text-based environments, achieving a top 10 position on the leaderboard among international participants.

EDUCATION

Bachelor of Science, Major in Computer Science and Statistics　　　　**Sept 2022 - Present**
University of British Columbia, Vancouver

- GPA: 4.0, Dean's List 2023, 2024
- MOCCA Lab Reading Group, Software Lead@Open Robotics, Undergraduate Mathematics Society, UBC Sikh Association
- Relevant Coursework: **Graduate** Learning to Move (Deep RL); **Undergraduate** Machine Learning, Advanced Data Structures & Algorithms, Statistical Inference, Linear Algebra

SKILLS

Frameworks	OpenCV, fastai, PyTorch, Tensorflow, SciKit/XGBoost, Swing, React, NumPy
Programming	Python, Java, C/C++, Git, JavaScript, TypeScript, LaTeX, Matlab, MarkDown
Graphics	Blender, Autodesk Maya, Unreal Engine, Adobe Illustrator

UBC Science Co-op