AMUTHEEZAN SIVAGNANAM

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Visa Status: U.S. Lawful Permanent Resident
Nationality: Sri Lanka
Location: State College, PA

Website | LinkedIn | Google Scholar

SUMMARY

Researcher and **Engineer** with a **PhD** in Informatics, bringing over **six** years of academic research and **two** years of industrial software development experience. Skilled in developing **scalable reinforcement learning** and **deep learning** methods for **optimization** and **decision-making** in complex systems. Strong publication record **(h-index: 7)** in top-tier venues. Proficient in **Python**, **TensorFlow**, **PyTorch**, and **AWS**, with experience in **Agile** and **CI/CD** practices for robust ML model **development** and **integration**.

EDUCATION

Pennsylvania State University
Ph.D., Informatics   *Aug 2022 - Aug 2025*
Dissertation: *Application of Deep Reinforcement Learning to Solve Optimization Problems in Transportation Domains*

University of Houston (*Transferred to Pennsylvania State University***)**
Ph.D., Computer Science   *Aug 2019 - Aug 2022*

University of Houston
M.S., Computer Science   *Aug 2019 - Aug 2022*

University of Moratuwa
B.S., (Hons) Engineering (Computer Science and Engineering)   *Jan 2014 - Jan 2018*
Final Year Project: *Sentimental Analysis of Twitter using Semi-Supervised Approaches*

RESEARCH INTERESTS

★ Reinforcement Learning
★ Optimization
★ Operational Research
★ Cyber-Physical Systems

SKILLS

- **Languages:** Python, C/C++, Java
- **AI & ML Libraries:** PyTorch, TensorFlow, Keras, Hugging Face, LangChain, LangGraph, DSPy, Scikit-learn, Scipy, NumPy, OpenAI Gymnasium, RLLib
- **Optimization Tools:** CPLEX, Gurobi, Mosek, Google OR-Tools
- **Data processing:** Pandas, Spark, Matplotlib
- **Databases:** SQLite, MySQL, OracleDB, MongoDB
- **Deployment:** Git, Docker, AWS (SageMaker, EC2, Lambda, S3)

RESEARCH EXPERIENCE

Pennsylvania State University   Graduate Research Assistant
Applied Artificial Intelligence Lab   *Aug 2022 - May 2025*

- Lead research projects funded by the **U.S. Department of Energy (DOE)** and the **National Science Foundation (NSF)**, introducing **cost-**and **energy-efficient** solutions to tackle real-world problems
- Analyzed current state-of-the-art and identified **research gaps** in prior works, leading to the development of **innovative algorithms** for **real-time decision-making**
- Introduce novel **problem formulations** and **mathematical models** to address real-world challenges, while ensuring inherent spatio-temporal and resource constraints
- Proposed **artificial intelligence**–based **solutions** to tackle **challenging** real-world problems and successfully **deployed** them in relevant **industries**
- Published **research findings** in **AI/ML conferences** (ICML) and assisted in preparing the slides for presenting results at **DOE** and **NSF** meetings

The University of Houston   Graduate Research Assistant
Resilient Networks and Systems Lab   *Sep 2019 - Aug 2022*

- Spearheaded research projects funded by the **U.S. Department of Energy (DOE)** and the **National Science Foundation (NSF)**, leading to advancements in **energy-efficient** technologies
- Focus on understanding real-world **decision-making problems** and identified **gaps** in existing solution approaches, leading to the development of **novel methodologies** for **enhanced decision-making**
- Propose novel **problem formulations** and **mathematical models** and formulated **problem statements** to effectively address the research limitations in prior research efforts
- Applied **artificial intelligence-**based **solution** approaches to **real-world** problems and successfully **deployed** them in relevant **industries**
- Published **research findings** in **AI conferences** (**AAAI**, **IJCAI**) and assisted preparing **slides** for presenting results at **DOE** and **NSF meetings**

INDUSTRY EXPERIENCE

LSEG Technology Software Engineer
Post Trade Team Jan 2018 - Jul 2019

- Developed application software following **object-oriented** design and development principles, enhancing **code maintainability** and **scalability**
- Followed **agile development practices**, such as **scrum**, to improve **team collaboration** and **project delivery speed**
- Developed software solutions using **Java**, **Python**, and **C++**, improving **system performance** and **reliability**
- Modified SQL-queries, tested against **BDD**, ensuring correctness of **system functionality**
- Enhanced **back-end regression** to achieve proper code coverage in based on unit-testing, ensuring **compatibility** and reducing **testing time**
- Developed a new **report generation system** for assessing the state of current testing framework, **automating email** at the end of regression
- Contributed to **code integration** and **deployment plans**, ensuring **seamless software updates** and minimizing **downtime**
- Participated in **professional training** programs conducted by Millennium IT Software and Post Trade Team
- Worked on front-end development for both **product** and **solution** which consists of **enhancement**, **bug fixing**, **merging** and **introducing new features**

WSO2 Lanka PVT Ltd Software Engineering Intern
Data Analytics Team Jul 2016 – Dec 2016

- Developed an HL7 Monitoring Solution by integrating **WSO2 ESB**, **DAS**, and **BAM**, enabling real-time and batch processing of healthcare data
- Developed an alert generation system analyzing descriptive **HL7/FHIR** data to monitor **disease outbreaks**, triggering timely email and SMS notifications
- Created **Spark scripts** for batch analytics and **Siddhi execution plans** for real-time alerts, including disease outbreak and patient wait-time notifications
- Engineered a mechanism to evaluate **hospital functionality** by assessing **admission and discharge** messages, including bed and oxygen cylinder availability
- Implemented interactive dashboards using **Jaggery**, **JavaScript**, **jQuery**, **Leaflet.js**, and **DataTables**, featuring gadgets like charts, maps, and tables
- Utilized **HAPI test panel** to simulate HL7 v2 messages and validate the monitoring pipeline end-to-end
- Packaged the entire monitoring solution as a **Carbon Application (CApp)**, bundling event streams, receivers, publishers, and visualization artifacts
- Attended workshops and gained hands-on experience with **Git**, **MSF4J (Microservices for Java)**, and **WSO2 product architecture** for enterprise middleware solutions

PUBLICATIONS

CONFERENCE PROCEEDINGS

[C1] **Sivagnanam, A.,** Pettet, A., Lee, H., Mukhopadhyay, A., Dubey, A., & Laszka, A. (2024). Multi-agent reinforcement learning with hierarchical coordination for emergency responder stationing. In *Proceedings of the 41st International Conference on Machine Learning (ICML)*.

[C2] **Sivagnanam, A**., Kadir, S. U., Mukhopadhyay, A., Pugliese, P., Dubey, A., Samaranayake, S., & Laszka, A. (2022, July). Offline vehicle routing problem with online bookings: A novel problem formulation with applications to paratransit. In *Proceedings of the Thirty-First International Joint Conference on Artificial Intelligence (IJCAI-22)* (pp. 3933–3939).

[C3] **Sivagnanam, A**., Ayman, A., Wilbur, M., Pugliese, P., Dubey, A., & Laszka, A. (2021, May). Minimizing energy use of mixed-fleet public transit for fixed-route service. In *Proceedings of the AAAI Conference on Artificial Intelligence (Vol. 35, No. 17, pp. 14930–14938).*

[C4] Sen, R., **Sivagnanam, A.**, Laszka, A., Mukhopadhyay, A., & Dubey, A. (2024). Grid-aware charging and operational optimization for mixed-fleet public transit. In *Proceedings of the 2024 IEEE 27th International Conference on Intelligent Transportation Systems (ITSC)* (pp. 4172–4179). IEEE.

[C5] Atefi, S., **Sivagnanam, A.**, Ayman, A., Grossklags, J., & Laszka, A. (2023). The benefits of vulnerability discovery and bug bounty programs: Case studies of Chromium and Firefox. In *Proceedings of the ACM Web Conference 2023 (WWW '23)* (pp. 2209–2219). Association for Computing Machinery.

[C6] Pavia, S., Rogers, D., **Sivagnanam, A.**, Wilbur, M., Edirimanna, D., Kim, Y., Mukhopadhyay, A., Pugliese, P., Samaranayake, S., Laszka, A., & Dubey, A. (2024). SmartTransit.AI: A dynamic paratransit and microtransit application. In *Proceedings of the Thirty-Third International Joint Conference on Artificial Intelligence (IJCAI '24)* (Article No. 1028, pp. 8767–8770).

[C7] Ayman, A., Wilbur, M., **Sivagnanam, A.**, Pugliese, P., Dubey, A., & Laszka, A. (2020). Data-driven prediction of route-level energy use for mixed-vehicle transit fleets. In *Proceedings of the 2020 IEEE International Conference on Smart Computing (SMARTCOMP)* (pp. 41–48). IEEE.

JOURNALS

[J1] Wilbur, M., Ayman, A., **Sivagnanam, A.**, Ouyang, A., Poon, V., Kabir, R., Vadali, A., Pugliese, P., Freudberg, D., Laszka, A., & Dubey, A. (2023). Impact of COVID-19 on public transit accessibility and ridership. *Transportation Research Record, 2677*(4), 531–546.

[J2] Ayman, A., **Sivagnanam, A.**, Wilbur, M., Pugliese, P., Dubey, A., & Laszka, A. (2021). Data-driven prediction and optimization of energy use for transit fleets of electric and ICE vehicles. *ACM Transactions on Internet Technology, 22*(1), Article 7, 1–29.

WORKSHOPS

[W1] **Sivagnanam, A.**, Atefi, S., Ayman, A., Grossklags, J., & Laszka, A. (2021). On the benefits of bug bounty programs: A study of Chromium vulnerabilities. In *Workshop on the Economics of Information Security (WEIS)* (Vol. 10).

BOOK CHAPTERS

[BC1] Wilbur, M., **Sivagnanam, A.,** Ayman, A., Samaranayake, S., Dubey, A., & Laszka, A. (2023, August). Artificial intelligence for smart transportation. In **Y. Vorobeychik & A. Mukhopadhyay (Eds.),** *Artificial Intelligence and Society* (book chapter). ACM Press.

PROJECTS

PHD RESEARCH PROJECTS

Dynamic Vehicle Routing with Advance Booking   *Oct 2023 – Aug 2025*

- Focus on a real-world micro-transit operations where riders may **book** rides in few hours **advance** with but expect **acceptance or rejection** at booking time
- Developed a **Deep Reinforcement Learning**(DRL)–based policy that learns to distinguish the high quality route plans that could increase the service rates
- Integrated an **anytime** VRP solver to periodically **enhance** the quality of routes **between** bookings, enabling enough room for future requests in the limited vehicles
- Achieved **100% service rate** and outperform other competitive state-of-the-art dynamic VRP baselines using **MCVRP** and **Google OR Tools** and **Rolling Horizon**, as demonstrated through experiments on **real-world** data from mid-size U.S. cities

Emergency Responder Stationing [Code]   *Nov 2021 – June 2024*

- Developed a novel multi-agent DRL with **hierarchical coordination** to address the **resource reallocation problem** in the context of **emergency responder management**
- Utilized the Deep Deterministic Policy Gradient (**DDPG)** algorithm to train agents in different hierarchy (i.e., **city-scale redistribution** (high-level) and **region-scale reallocation** (low-level))

- Incorporated a **Transformer-based** actor network to handle **variable numbers of responders** in region-scale reallocation
- Leveraged **min-cost flow** (city-level) and **max-weight matching** (region-level) to ensure precise and **feasible mapping** from continuous to discrete actions, while preserving **gradient flow** during training
- Integrated **low-level critics** to provide **reward feedback** to high-level agents, enhancing **training stability** and **performance**
- Achieved **1000× faster** decision-making and **reduced response delays by 5–13 seconds** on **real-world** datasets from Nashville, TN and Seattle, WA

The Benefits of Vulnerability Discovery and Bug Bounty Programs   *Feb 2020 – May 2023*

- Collect and compose the publicly available **chromium data** using **Monorail API**, **Google Release Notes** and **Google Chrome Hall of Fame**
- Perform intensive **data cleaning** process to **identify** the original reporters (achieve an **accuracy of 98%**), **duplicates** issues**,** and time at which the issue got **patched** and **released** to public
- Demonstrated that bug-bounty programs **complement** the efforts internal security teams by uncovering a diverse range of vulnerability types from external bug-hunters
- Delivered **actionable insights** to enhance bug-bounty effectiveness, including **targeted guidance** for bug hunters toward vulnerabilities with risk of real-world exploitation potential

Offline Vehicle Routing Problem with Online Bookings [Code]   *Feb 2020 – Jul 2022*

- Focus on a real-world paratransit operations where riders **book** trips in **advance** with **time flexibility** but expect **tight pickup windows** at booking time
- Introduced **a novel problem formulation** that blends the **scalability** of offline VRP with the **real-time responsiveness** of dynamic VRP
- Developed a **DRL–based policy** that learns to assign optimal time windows under demand uncertainty and booking-time constraints
- Integrated an **anytime** VRP solver to incrementally **enhance** the quality of route plans **between** bookings, enabling better utilization of limited vehicles
- Achieved at-least **20% cost reduction** over baseline methods using **Google OR Tools** and **VRoom** with naive window assignments, as demonstrated through extensive experiments on **real-world** data from paratransit-operations of Chattanooga, TN

Minimizing Energy Use of Mixed-Fleet Public Transit [Code]   *Aug 2019 – May 2021*

- Formulated a **mathematical model** to **optimize** energy consumption for public transit agencies operating mixed fleets of electric vehicles (EVs) and internal combustion engine vehicles (ICEVs)
- Transformed the model into an Mixed Integer Linear Programming (MILP) formulation to obtain **exact** solutions for **small** to **medium-sized** problem instances
- Developed a **scalable** solution approach combining **heuristics** and **metaheuristics** (e.g., **local search**, **genetic algorithms**) to **efficiently** solve large-scale instances in polynomial time
- Introduced heuristics and metaheuristics **perform reasonably** well close to **MILP,** and and the **difference cap at 60%**

- Reduced **annual energy costs** by **$140K** for the Chattanooga public transit agency through the proposed approach

UNDERGRAD RESEARCH PROJECT

Sentimental Analysis of Twitter using Semi-Supervised Approaches   *Nov 2016 – Nov 2017*

- Developed a **sentiment analysis** model to classify tweets identify the polarity of tweets as **positive, negative, and neutral**
- Utilized **semi-supervised learning techniques**, including self-training, co-training, to address **limited** and **noisy labeled data**
- Initiated training with a small **manually-labeled** dataset, and iteratively expanded it by **automatically labeling** based on high-confidence data (i.e., tweets)
- Among training strategies **co-training** results in **superior** results in terms of F1-score

UNDERGRAD INTERNSHIP PROJECT

HL7 Monitoring System   *July 2016 – Dec 2016*

- Built an end-to-end **HL7/FHIR monitoring** system using WSO2 ESB, DAS, and BAM for both **real-time (Siddhi)** and **batch (Spark)** analytics of healthcare data
- Designed an **alert** system to detect disease **outbreaks** and **long patient wait times**, delivering **email** and **SMS** notifications based on HL7/FHIR data streams
- Engineered hospital **functionality assessments** by analyzing admission/discharge events, tracking resources like **bed** and **oxygen cylinder availability**
- Developed **interactive** dashboards with Jaggery, JavaScript, Leaflet.js, and DataTables, and packaged the solution as a **WSO2 Carbon Application (CApp)** for easy deployment

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TALKS

IJCAI (Vienna, Austria)   2022
For the paper: Offline Vehicle Routing Problem with Online Bookings:
A Novel Problem Formulation with Applications to Paratransit

WEIS (Virtual Workshop)   2021
For the workshop paper: On the Benefits of Bug Bounty Programs:
A Study of Chromium Vulnerabilities

AAAI (Virtual Conference)   2021
For the paper: Minimizing Energy Use of Mixed-Fleet Public Transit
for Fixed-Route Service

SERVICES

Program Committee Member
International Joint Conference on Artificial Intelligence (AI For Social Good)   2025

Reviewer
International Joint Conference on Artificial Intelligence (AI For Social Good)   2024

Reviewer
AI4Research Workshop @ IJCAI2024   2024

Auxiliary Reviewer
22nd International Conference on Autonomous Agents and Multiagent Systems   2023

AWARDS AND HONORS

Scholarship   2022/08 - 2025/08
Graduate Tuition Fellowship, Pennsylvania State University

Scholarship   2019/08 - 2022/08
Graduate Tuition Fellowship, University of Houston

Information Security Quiz 2015 - Runners Up   2015
Issued by Sri Lanka Computer Emergency Readiness Team (SLCERT)
and Information and Communication Technology Agency of Sri Lanka (ICTA)

Mahapola Scholarship   2014 - 2017

REFERENCES

Dr. Aron Laszka (PhD Supervisor)
Position: **Assistant Professor**
Affiliation: **Pennsylvania State University**
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Dr. Weidong Shi
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