Manu Lahariya

PhD Candidate
Artificial Intelligence, UGent

Born on April 20th, 1994
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As a researcher, I am eager to learn, persistent, analytical, and look for creative solutions. My goal is to study how physical laws can assist the development of artificial intelligence and innovative solutions.

Scientific interests

- Physics Based Machine Learning
- Reinforcement Learning (RL)
- Deep learning
- Smart Grids, Demand Response (DR)
- Soft Robotics

Education

2023. **PhD - Computer Science Engineering**, AI4SG Group, Ghent University (Belgium)

2017. **Masters - Aerospace Engineering**, IIT-KGP (India)

2016. **Bachelor - Aerospace Engineering**, IIT-KGP (India)

Awards

- BuildSys' 2019 | Best poster runner-up.
- EXL excellence quotient' 2016 | Accuracy Champion.

Current Position

Mar. 2019 – Mar. 2023. **PhD Candidate**
- *Artificial Intelligence for Smart Grids group, Ghent university, Belgium*

Research on physics-based machine learning, reinforcement learning, and statistical modeling for designing efficient control for different demand response applications in smart grids.

Selected Publications

M. Lahariya, C. Innes, C. Develder, S. Ramamoorthy, **(2022)**
Learning physics-informed simulation models for soft robotic manipulation: A case study with dielectric elastomer actuators, *link, under review in Robotics and Automation Letters and IROS 2022*

M. Lahariya, F. Karami, C. Develder and G. Crevecoeur, **(2022)**
Physics Informed LSTM Network for Flexibility Identification in Evaporative Cooling Systems, *link, IEEE transactions on industrial informatics*

List of all publications: https://mlahariya.github.io/publication/

Research Projects

Aug. 2021 – Nov. 2021. | **Visiting Researcher** | **Collaboration - RAD Lab**
- *Robust Autonomy and Decisions Group, University of Edinburgh, UK*

Defined physics based framework to design close-loop control of Dielectric Elastomer Actuators (DEA) soft robots using physical laws, RL/MPC and finite element methods (FEM). Introduced and evaluated the concept of learning intrinsic latent soft robotic behaviour using physics based neural networks.

Apr. 2021 – Ongoing | **PhD Researcher** | **EU Funded - BIGG**
Developed and evaluated a physics based machine learning simulator for gas flexibility in space heating, as a contribution to BIGG analytics platform ($\leq 0.1\%$ *error*). Currently exploring potential of physics based RL as demand response for cost reduction, by joint coordination of residential complexes.

Jul. 2020 – Dec 2021. | **PhD Researcher** | **EU Funded - InduFLEX**
Designed PhyLSTM, a recurrent neural network extension of novel PINN for system identification in industrial processes. PhyLSTM produced $\leq 1\%$ *error* and displayed high potential for developing RL/MPC based DR control in dynamic systems in smart grids, e.g. Evaporative Cooling Systems (ECS).

Mar. 2019 – Ongoing | **PhD Researcher** | **Independent Research**
- Studied RL based joint coordination of Electrical Vehicle (EV) fleet using fitted Q-iterations (FQI) algorithm. Trained Deep Q Network (DQN) RL policy achieves 40% load flattening compared to Business as Usual policy. Explored linear vs quadratic cost functions and multiple MDP formulations. Now exploring other RL algorithms for improving learned policy (e.g. PPO, TRPO).
- Introduced and tested a data driven statistical model for EV chagrining sessions based on gamma/exponential distributions. Implemented the Synthetic Data Generator based on this model ($\leq 5\%$ *error*) and released on GitHub.

Industry Experience

Jul. 2017 – Jul. 2018. | **Forecasting Expert**
- *Business Consulting, Decision Analytics Associate, ZS Associates, India*

Analyzed ARIMA, ARIMAX, Neural Networks, and DeepAR (AWS), etc., for time-series modeling of ex-factory sales. An integral part of a team that developed a data science based sales forecasting package for pharma industry.

May. 2016 – Jul. 2016. | **Data Scientist**
- *Data Science Intern, Ethnus Consulting Services, Bangalore, India*

Assisted business development team by developing analytic dashboards to investigate PAN India markets. Proposed top 100 market hubs based on ML models (e.g. clustering (KNN), regression, NN, etc.) trained on scrapped data.

Coursework

- *Ghent University:* Machine Learning, Artificial Intelligence, Big Data.
- *IIT Kgp:* Linear Algebra, Probability & Statistics, Engineering Mathematics.
- *Online:* Introduction to Algorithms, ISLR, Data Science Specialization in R.

Programming Libraries

- *Python:* TensorFlow, Keras, PyTorch, SciKit-Learn, Matplotlib, MLflow
- *R:* ggplot2, Shiny, caret, dplyr, tidyr, xgboost

Coding Skills	Transferable Skills	Languages
Python, R	Interpersonal skills	Fluent: *English*
Excel, SQL	Communication skills	Native: *Hindi*
Matlab, abaqus	Project Management	Beginner: *Japanese*

Personal Projects

Nov. 2019 – Mar. 2021. | **Public Relations Officer**

- *Ghent Model United Nations, Ghent, Belgium.* Organizing team member of MUN responsible for PR, participant experience and conference website. Key leadership role in managing pandemic impact on the conference organization.

Jan. 2015 – Apr. 2017. | **Co-Founder & Core Team Head**

- *Space Technology Awareness Camps (STAC), collaboration with ISRO, India.* National initiative for promoting space technology enthusiasm in the student community of India. Led a 3 tier team of 15, launched the initiative in 200+ colleges in India.

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