

# NIMISH M AWALGAONKAR

<https://www.predictivesciencelab.org>

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## PROFESSIONAL INTERESTS

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- Artificial Intelligence, Machine Learning, Statistics, Data Science.
- Deep Learning, Graphical Models, Bayesian Methods, Recommender Systems, and Decision Theory.
- Uncertainty Quantification, Decision Making under Uncertainty, Design of Experiments

## EXPERIENCE

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### Data Scientist Intern

May 2019 - August 2019

*ExxonMobil Research and Engineering Company, Clinton, New Jersey*

- Introduced and spearheaded the development of DeepExxonMobilEye package to address various computer vision needs of EMRE; applications include automated video surveillance systems, flare detection etc.
- Organized and tackled computer vision tasks in a hierarchical fashion: image classification  $\rightarrow$  object detection  $\rightarrow$  semantic segmentation  $\rightarrow$  image captioning  $\rightarrow$  dense captioning  $\rightarrow$  establishing visual relationships.
- Surveyed and worked (training/inference) with state of the art Deep Neural Networks such as ResNet, DenseNet, SqueezeNet, RetinaNet, YoloV3, RCNNs, Mask-RCNN, Encoder-decoder networks (CNNs/RNN-LSTMs) etc.
- Collected, analysed and handled image/video datasets from multiple sources: ImageNet, MS-COCO, KITTI, OpenImages, Visual-Genome, AIM, VIRAT, Cityscapes etc. for training concerned deep neural networks.

### Givens Summer Associate

June 2018 - August 2018

*Argonne National Laboratory, Mathematics and Computer Science Division, Chicago*

- Introduced and developed embarrassingly parallelizable global optimization methods for expensive, black-box experiments and simulations; applications included hyperparameter optimization of deep neural networks, parameter configuration of parallel computing systems etc.
- Assisted in development of neural architecture search framework which would automate the process of finding the optimum deep learning architecture to address different supervised/unsupervised machine learning problems.

## EDUCATION

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### Ph.D in Mechanical Engineering (3rd year, ongoing)

June 2016 - Present

#### Predictive Science Modeling Lab

Specializing in **Uncertainty Quantification, Machine Learning, Bayesian Statistics**

Purdue University, CGPA: **3.67/4**

**Relevant Coursework:** Deep (Neural Networks) Learning, Advanced Machine Learning (Causal Inference), Bayesian Data Analysis, Stochastic Processes, Stochastic optimization of Machine Learning algorithms.

### M.S in Mechanical Engineering

August 2014 - June 2016

Purdue University, CGPA: **3.5/4**.

**Relevant Coursework:** Machine Learning, Machine learning in Natural Language Processing, Computational Optimization Methods, Advanced Data Analysis, Uncertainty Quantification, Numerical Analysis.

### B.Tech with Honours in Mechanical Engineering

August 2010 - June 2014

Specialization in Energy Engineering

(**Only student** to graduate with an **Honours** degree)

VIT University, Honours GPA: **8.94/10**, CGPA: **8.75/10**

**Relevant Coursework:** Operations Research, Numerical Methods, Partial Differential Equations

## PROGRAMMING AND DEVELOPMENT SKILLS

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**Languages** Python, R, Matlab, C++, C  
**Tools** PyTorch, Keras, Tensorflow, Pymc, Pymc3, GPy, GPFlow, STAN

## ENGINEERING AND RESEARCH EXPERIENCE

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**Bayesian Recommender System** May 2017 - Dec 2018

- Formulated and designed the recommendation system as a design of experiments (Bayesian Global Optimization) problem for finding the most preferred state (what humans like) with limited data.
- Introduced Gaussian processes (with unimodality constraints) for modeling utilities/preferences of occupants; resulting in development of open-source GPPrefElicit package (available on GitHub).

**Bayesian Preference Learning Model** May 2016 - May 2017

- Formulated the preference learning problem as a machine learning classification problem; application include behavioral choice modeling (analyzing pair-wise comparison data) to learn the preferences (utilities) of humans.
- Developed non-parametric Bayesian methods (Gaussian Processes) for modeling utilities and associated uncertainty resulting in statistics of the predictions outperforming conventional Frequentist machine learning algorithms; also delivering GPPrefLearn package (available on GitHub).

**Learning Community-Based Preferences Via Collaborative GPs** March 2019 - ongoing

- Introduced and spearheaded the development of GPActToPref package for learning community based preferences of different occupants (smart buildings context) through their actions/behavior.
- Developed a probabilistic model combining supervised GP learning of occupants' preferences with unsupervised dimensionality reduction for multi-occupant systems.

**Learning Arbitrary Quantities of Interest via Bayesian Design of Experiments** Jan 2019 - May 2019

- Introduced and spearheaded the development of fully-bayesian, non-stationary Gaussian process based models for approximating latent information sources; resulting in development of AdaptiveGP package (available on Github).
- Derived an approximation of the information gain of a hypothetical experiment about an arbitrary QoI conditional on the hyper-parameters; resulting in development of AdaptiveBODE package (available on Github).

**Scalable Bayesian Optimization using Deep Neural Networks and Parallelizable Acquisition Functions** May 2018 - Oct 2018

- Explored the use of different scalable surrogate models like deep nets, random forests etc. as an alternative to Gaussian Processes based bayesian global optimization algorithms.
- Explored the use of different batch acquisition functions for achieving a previously intractable degree of parallelism.
- Employed the newly developed framework for hyperparameter optimization in deep neural nets, automatic performance tuning methods etc.

**Information Fusion from Different Experiments using Hierarchical Bayesian Models** Oct 2018 - Nov 2018

- Ask for more details.

**Hierarchical Bayesian Models for Residential Energy Consumption** Aug 2016 - Dec 2016

- Modeled Bayesian mixed effects (hierarchical) model to quantify epistemic uncertainty associated with predictions.
- Tried to establish causal relations (cause-effect) for possible government policy interventions in near future.

**Hierarchical Bayesian Models for Predicting Human Behavior** Aug 2015 - Aug 2016

- Modeled human-machine interactions (motorized roller shades and dimmable electric lights) as a probabilistic graphical model; resulting in up to 1.75 times more accurate predictions over existing state-of-the-art algorithms used for modeling occupant actions.

- Demonstrated the advantages of the Bayesian approach that captures the epistemic uncertainty in the model parameters; important when dealing with small-sized datasets, an ubiquitous issue in human data collection.

### Model Predictive Control under Uncertainty

Dec 2016 - Dec 2017

- Assisted in the development of stochastic model control strategy enabling efficient uncertainty quantification; application include building-integrated solar systems.
- Formulated the above problem as approximate dynamic programming problem to handle optimal control problem.
- Employed MPI library to use 80-100 nodes of Rice supercomputing cluster at Purdue to significantly reduce the computation time (about 30 minutes for computation of policy function at each step).

### Time Series Forecasting using Particle Filters and Deep Learning

Dec 2016 - May 2017

- **Application:** Solar Irradiance Prediction Using Satellite Data
- Examined and implemented different Image processing algorithms (using Radon Transforms, FFTs, Super Resolution, etc) to extract meaningful features out of the cloud based image data at hand.
- Organized and compared different state of the art stochastic dynamical systems; Long Short-Term Memory Recurrent Neural Networks (LSTM RNNs) performed best among all (Ensemble Kalman Filters, Particle Filters).

### Assited work

Aug 2014 - ongoing

- Design of Experiments for Optimal Graphene Growth using a Chemical Vapor Deposition Reactor (*mentor*).
- Using Temporal Convolutional Deep Neural Networks for Traffic Flow Prediction (assisting a colleague).

## RELEVANT RESEARCH PUBLICATIONS

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Nimish Awalgaonkar, Haining Zheng, Chris Gurciullo, and Jeff Ludwig. Deep exxonmobil eye: A deep learning based computer vision package for addressing the safety and security needs of workers across different sites. *work in progress*, 2019

Nimish Awalgaonkar, Ilias Bilonis, Xiaoqi Liu, Panagiota Karava, and Athanasios Tzempelikos. Learning personalized thermal preferences via bayesian active learning with unimodality constraints. *arXiv:1903.09094*, 2019

Nimish Awalgaonkar, Jie Xiong, Ilias Bilonis, Athanasios Tzempelikos, and Panagiota Karava. Design of experiments for learning peronsalized visual preferences of occupants in private offices. 2018

Seyed Amir Sadeghi, Nimish M Awalgaonkar, Panagiota Karava, and Ilias Bilonis. A bayesian modeling approach of human interactions with shading and electric lighting systems in private offices. *Energy and Buildings*, 134:185–201, 2017

Jie Xiong, Athanasios Tzempelikos, Ilias Bilonis, Nimish M Awalgaonkar, Seungjae Lee, Iason Konstantzos, Seyed Amir Sadeghi, and Panagiota Karava. Inferring personalized visual satisfaction profiles in daylit offices from comparative preferences using a bayesian approach. *Building and Environment*, 138:74–88, 2018

Xiaoqi Liu, Parth Paritosh, Nimish M Awalgaonkar, Ilias Bilonis, and Panagiota Karava. Model predictive control under forecast uncertainty for optimal operation of buildings with integrated solar systems. *Solar Energy*, 171:953–970, 2018

Seyed Amir Sadeghi, Nimish M Awalgaonkar, Panagiota Karava, and Ilias Bilonis. A bayesian approach for modeling occupants' use of window shades. 2016

Atharva Hans, Ilias Bilonis, Timothy S Fisher, Majed Abdullah Alrefae, Nimish M Awalgaonkar, and Piyush Pandita. Process optimization of graphene growth. 2017

## ACTIVITIES AND AWARDS

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Only student to graduate with Honours degree in the School of Mechanical Engineering, 2014.

Recipient of Donald English Fellowship, Mechanical Department, Purdue University for the year 2015.

Recipient of the National Talent Search (NTSE) Scholarship (2008 - 2014).