S. Mohammad H. Hosseini Dastjae

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Research Interests

- Probabilistic Machine Learning
- Generative Models
- Statistical Inference
- Statistical Learning Theory
- Stochastic Calculus

Education

University of Isfahan *Isfahan, Iran*

BSc in Computer Engineering *Sept 2019 - Jul 2023*

- **Thesis:** Photo Enhancement via Generative Modeling. ***Mark: 20/20***
- **Last Three Years GPA:** 18.11/20

University of Isfahan *Isfahan, Iran*

BSc in Electrical Engineering *Sept 2017 - Sept 2019*

- **Changed Program to Computer Engineering**

Publications

Enhanced Meta-learning Forecasting Leveraging Score-based Time Series Modeling *To be Submitted*

E Mirafzali, **S M Hosseini Dastjae**, S Barak

- Supervised by Dr. Barak at the University of Southampton

Insights into Boosting Meta-learning Forecasting Via Diffusion Models *Ongoing*

S M Hosseini Dastjae, E Mirafzali, S Barak

- Supervised by Dr. Barak at the University of Southampton

Research

Photo Enhancement via Generative Modeling

Thesis, Supervised by Dr.H Mahvash Mohammadi *Winter, 2023*

- Main work consisted of implementation of and working with methods of *generating higher quality conditional samples from low quality images, such as photos with bad lighting and/or low resolution.*
- Worked with 3 main approaches, *Normalizing Flows* (LLFlow Model), *Variational Bayes*(LUD-VAE Model) and *Generative Diffusion Models*(Conditional Denoising Diffusion Probabilistic Model)

Score-based Generative Modeling

Research Project for Graduate Course **Pattern Recognition** *Fall, 2022*

- Using score estimation methods as a way of achieving data distribution
- Using *Stochastic Differential Equations* modelling of *Generative Diffusion Models* to generate novel samples.
- Working with *Maximum Likelihood* training of score-based diffusion models.

Variational Inference

Research Topic Chosen in **Research and Representation** Course. **Mark: 19.61**/20 *Fall, 2021*

- A survey on different methods in *Variational Inference*.
- Multiple presentations on *Black Box Variational Inference* and *Stochastic Variational Inference*.
- Worked with *Implicit Reparameterization of Gradients* in Variational Inference.

Experiences

Teaching Experience

Instructor *University of Isfahan(Ongoing)*

- Chosen by the faculty of CE as the **instructor** for an **online course on deep learning**
- Covered introductory applications of deep learning in computer vision and natural language processing with implementations in PyTorch.
- Introduction to more **advanced topics** such as *generative models (VAEs, GANs) and continuous time networks(Neural ODEs, Deep Equilibrium Models)*.

Teaching Experience

Teaching Assistant *University of Isfahan (Winter 2020)*

- Holding practicum lab classes as a **Teaching Assistance** in **Advanced Programming** course taught by Prof. R. Ramezani.
- Selection and grading of homeworks.

Internship

Artificial Intelligence Intern

Partotech System

Mar 2022 - Oct 2022

- Sentiment analysis of user feedback using **BiLSTM**.
- Recognition of objects in newspapers using **YOLO** architecture.
- Worked on an implementation of **Latent Dirichlet Allocation**, as a proposed approach to **Topic Modeling**.

Volunteer Work

Mentor

University of Isfahan Artificial Intelligence Community

Feb 2020 - Present

- Acting as a senior mentor in BSc of computer engineering for younger students pursuing machine learning.
- Writing articles about **Statistical Machine Learning** in the upcoming first issue of **UI AI Magazine**.

Projects

Time Series Generation and Score Extraction

Development of DiFeature module in **MetaTS package**

Implemented SDE modeling for diffusion processes to generate time series data and extract distribution scores.

Generative Models

Implementation and Assessment of Different Approaches to Generative Modeling

- Implementation of **Probabilistic** and **Implicit Denoising Diffusion Models**, generating samples from Oxford Flowers 102
- Generation of images based on CIFAR-10 dataset using an **autoregressive model**, PixelCNN
- Data generation with the **Normalizing Flows** approach by implementation of Real NVP
- Evaluation of **GANs** as an implicit generative model and **Energy-based GANs** as a solution to some of their shortcomings.
- Implementation of likelihood generative models, **Variational Auto Encoder**, an approach to a regularized latent space.

Scheduling

Project for Real Time Systems Course

- Posing scheduling in real time operating system as *Job Shop Scheduling* problem and using meta-heuristic methods as a solution.
- Presenting **Deep Lagrangian Networks** and *Genetic Algorithms* as solutions to the job shop scheduling problem.

Artificial Intelligence Algorithms

Project for *Artificial Intelligence* Course

- *Exploratory Data Analysis* on different datasets.
- Implementation of **Permutation Genetic Algorithm** and introduction of **Deletion Mutation** to generate best permutation subset of set.
- Implementation of *Value Iteration* as a solution to *Markov Decision Processes*.
- Implementation of *Q-Learning* as a solution to a non-deterministic grid-based game.

Inference and Density Estimation

Learning latent information and hidden underlying structures

- Implementation of **Mean Field** Variational Inference.
- Implementation of **Automatic Differentiation** Variational Inference.
- Using a *Multivariate Gaussian Mixture Model* to estimated data density via **Expectation Maximization**.

Computer Vision

Topology and Attention in vision

- Implementation of the *Vision Transformer* **(ViT)** from scratch as a base model of using attention in image-based tasks.
- Experience with using **Persistent Homology** in analyzing images.

Graph Neural Networks

Using graph networks for property prediction in graphs

- Implementation of *Graph* **Attention** and *Graph* **Convolution** for graph classification.

Unsupervised Learning

Clustering

- Worked with hard clustering methods via implementation of *K-Means* and *K-Modes*.
- Soft Clustering using Fuzzy Logic, *Fuzzy Clustering C-Means*.

Stochastic Processes

Working on methods that factor in the uncertainty

- Implementation of **Gaussian Process Regression** as a method for achieving a more robust model.
- Using *Dropout* to capture uncertainty in neural networks.

Natural Language Processing

Text Summarization

Using *Text-to-Text Transfer Transformers* **(T5)** for summarizing text data.

Certifications and MOOCs

Deep Learning Specialization (DeepLearning.AI)
Probabilistic Graphical Models Specialization (Stanford)
Artificial Intelligence (IPM)
Machine Intelligence (Waterloo)
Deep Learning (NYU)
Probabilistic Machine Learning (Tubingen)
Probabilistic Systems (MIT)
Intro to Machine Learning (Kaggle)
Intermediate Machine Learning (Kaggle)
Feature Engineering (Kaggle)
Sharif Neuroscience (SNS)
Machine Learning (Stanford)
Learning from Data (Caltech)
Probability (Harvard)
Basic Analysis (AUT)
Mathematical Analysis (AUT)
Topology (IUT)
Algebra (Harvard)
Stochastic Processes (Leipzig)
Probability Theory (Max Planck)

Selected Courses

- Pattern Recognition: 15.84/20 **Grad CE**
- Artificial Intelligence: 17.5/20
- Linear Optimization:19.1/20 **Math Dept.**
- Linear Control: 20/20
- Electrical Circuits: 19.77/20
- Computer Aided System Design:19.44
- Advanced Programming: 20/20
- Robotics Lab: 20/20
- Interface Circuits: 19.83/20
- Embedded Real-time Systems: 19.5/20
- Computer Networks: 19.25/20
- Compiler Design: 19.5/20
- Computer Networks: 18.72/20

Skills and Familiarities

Programming	Python, Java, C++
Frameworks and Libraries	PyTorch, PyTorch Lightning, GPyTorch, TensorFlow Probability, TensorFlow, JAX, Scikit-Learn
Statistical Inference	Belief Propagation, Markov Chain Monte Carlo , Variational Inference
Generative Models	Energy Based Models, Flow Models, Diffusion Models, Score-based Models, Variational Models
Machine Learning	Reinforcement Learning, SVM, PGM, Gaussian Processes
Deep learning	Auto Encoders, CNN, RNN, GNN, LSTM, Attention Models
Dimensionality Reduction	PCA, LDA, Isomap, LLE, t-SNE, ICA

Languages

English	TOEFL Overall Score: **111** (Reading: **29**, Listening: **30**, Speaking: **28**, Writing: **24**)
Persian	Native proficiency

Interests

Math	For me, Mathematics has become an important part of life. More than the enjoyment I receive from following Pure Mathematics in Machine Learning, I enjoy learning math itself. My passion for Mathematics has given me the ability to work with deeper concepts in research. Therefore, my plan is to alongside growing my familiarity with Analysis, Topology and Stochastic Calculus dive deeper into pure mathematics and use its inspiration in Machine Learning.
Movies	One of the biggest hobbies of mine has always been watching movies, from absolute classics like Gone with the Wind to more recent works like Whiplash, there is not a great movie that I let pass me by easily