Shanu Kumar

Data and Applied Scientist, Microsoft
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Education

2019 **B. Tech in Electrical Engineering, Indian Institute of Technology, Kanpur** GPA: 8.63/10
Silver Medalist, *Minor: Machine Learning*

Research Interests

Computer Vision, Domain Adaptation, Natural Language Processing, Machine Learning

Achievements

2019 Awarded **Proficiency Prize** by IIT Kanpur for outstanding undergraduate research
2018 Received **A*** (top 1%) grade for exceptional performance in the course "Neural Network"
2017 Received **Academic Excellence Award**, awarded to Top 5% students in IIT Kanpur
2015 Secured **All India Rank - 2499** in **JEE Advanced** among 1.25 lakh Candidates

Publications

2019 **Attending to Discriminative Certainty for Domain Adaptation**
Vinod Kumar Kurmi,* **Shanu Kumar***, *Vinay P. Namboodiri*
*In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (***CVPR***), 2019 [Paper]*

2019 **Adversarial Adaptation of Scene Graph Models for Understanding Civic Issues**
Shanu Kumar, *Shubham Atreja, Anjali Singh and Mohit Jain*
*In Proceedings of the International World Wide Web Conference (***WWW***), 2019 [Paper]*

2019 **Aligning the Certainty of Classifier for Domain Adaptation**
Shanu Kumar*, *Vinod Kumar Kurmi*, Vinay P. Namboodiri*
[Under Review]

Internship

May-Jul 2018 **Adversarial Adaptation of Scene Graph Models for Understanding Civic Issues**
Research Intern at IBM India Research Laboratory, Bangalore
Supervisor: Shubham Atreja

- Proposed a novel application of existing Scene Graph models by adapting them to generate a **Civic issue graph** for understanding civic issues present in an image.
- Created two **multi-modal** datasets with bounding boxes and descriptions about civic issues.

Research Projects

Jan-Apr 2019 **Aligning the Certainty of Classifier for Domain Adaptation**
Undergraduate Project at IIT Kanpur
Supervisor: Prof. Vinay P. Namboodiri

- Proposed a method for generating **certainty activation maps** of the classifier, and improved classifier's certainty by aligning certainty activation maps across source and target domain.
- Achieved state of the art results on *Office Home*, *Office-31* and *ImageCLEF-2014* datasets.

Sep-Nov 2018 **Attending to Discriminative Certainty for Domain Adaptation**
Undergraduate Project at IIT Kanpur
Supervisor: Prof. Vinay P. Namboodiri

- Proposed a method to identify **adaptable** regions using the **certainty estimates** of discriminator for improving classifier's performance on target dataset.
- Achieved state of the art results on *Office Home*, *Office-31* and *ImageCLEF-2014* datasets.

Aug-Oct 2018

Knowing When to Adapt: A Bayesian Approach for Domain Adaptation

Undergraduate Project at IIT Kanpur
Supervisor: Prof. Vinay P. Namboodiri

- Proposed a **Bayesian framework** for domain adaptation by transforming both the Classifier and Discriminator into Bayesian Neural Networks using **Monte Carlo-Dropout** approach.
- Achieved improvement over the Non-Bayesian Model on *Office Home* and *Office-31* datasets.

Jan-Apr 2018
report

Hierarchical Word Sense Disambiguation using WordNet Senses

Undergraduate Project at IIT Kanpur
Supervisor: Prof. Harish Karnick

- Developed an end to end **Hierarchical model** based on synset and lexicographer number of **WordNet** senses for predicting senses sequentially for each word in the sentence.
- Applied **convolutional neural networks** on word vectors for capturing the context of the word and the local features around a neighborhood of the word.

Course Projects

Mar-Apr 2019
report

Semi-Supervised Learning with Auxiliary Deep Generative Models

Course Project for Topics in Probabilistic Modeling and Inference under Prof. Piyush Rai

- Implemented the research paper:*"Unsupervised Machine Translation using monolingual corpora only"*
- Proposed **graph convolutional networks** (GCN) based autoencoder that imposes structure into the latent space representation for languages with complex grammar rules.

Mar-Apr 2019
report

Unsupervised Domain Adaptation for Semantic Segmentation

Course Project for Visual Recognition under Prof. Vinay P. Namboodiri

- Studied the research paper *"Learning to Adapt Structured Output Space for Semantic Segmentation."*
- Improved the unsupervised semantic segmentation of IIT Kanpur Surveillance videos by adapting the domains in a progressive manner: from GTA V to Cityscapes, then to IITK dataset.

Jan-Apr 2018
report

Unsupervised Machine Translation using Structured Latent Space

Course Project for Natural Language Processing under Prof. Harish Karnick

- Implemented the research paper:*"Unsupervised Machine Translation using monolingual corpora only"*
- Proposed **graph convolutional networks** (GCN) based autoencoder that imposes structure into the latent space representation for languages with complex grammar rules.

Aug-Nov 2017
report

Bidirectional Attention Flow for Machine Comprehension

Course Project for Machine Learning under Prof. Purushottam Kar

- Studied and implemented research paper:*"Bidirectional attention flow for machine comprehension"*
- Included grammatical structure in the word embeddings by using part-of-speech embedding.

Jan-Apr 2018
github

Visual Motor Control of Robotic Arm

Course Project for Neural Network under Prof. Laxmidhar Behera

- Implemented neural network based **Single Network Adaptive Critic** (SNAC) and **Self-Organizing Maps** (K-SOM) for visual motor control of a robotic arm in TensorFlow.

Other Projects

May-Jun 2017
github

Relation Classification using Bidirectional LSTM Tree

Project Supervisor Prof. Harish Karnick

- Developed a model to classify the relation between two given entities in a sentence.
- Applied **Bidirectional tree structured LSTMs** on the shortest dependency path between a pair of entities in dependency tree for jointly representing both entities and relations.

Nov-Dec 2016
github

Automatic Quality Assessment of Wheat Grain

Project Supervisor Gaurav Agrawal, Assistant Secretary, Department of Agriculture, India

- Facilitated the process of automatic quality assessment of grains with impurity from images.
- Created a dataset of different qualities of wheat grain images, captured from Anaj Mandi.

Nov-Dec 2016 | **Kernelized Correlation Filter Based Object Tracking**
github | *Project Supervisor Prof. Vinay P. Namboodiri*

- Studied research paper:"*High-Speed Tracking with Kernelized Correlation Filters*" by Joao et. al.
- Tried to improve KCF tracker by using the feature maps from pretrained VGG16 network.

Travel Grant Awards

- Received Conference Travel Grant from Microsoft Research India for attending CVPR 2019
- Received Conference Travel Grant from Indian National Academy of Engineering for attending CVPR 2019
- Received Conference Travel Grant from Microsoft Research India for attending WWW 2019

Conferences and Workshops Attended

- Presented my work on *Discriminative Certainty based Attention* in a poster session at CVPR 2019 in Long Beach
- Presented my work on *Unsupervised Adaptation of Scene Graphs* in a poster session at WWW 2019 in San Francisco

Relevant Coursework

Probabilistic Modeling & Inference	Probability & Statistics	Visual Recognition	Machine Learning
Natural Language Processing	Data Structure & Algorithm	Linear Algebra and ODE	Neural Network

Technical Skills

Programming Languages	Python, C, C++, Lua
Deep Learning Libraries	Torch, PyTorch, TensorFlow
Tools	NumPy, Scikit-learn, MATLAB, Django, LaTeX, Git

Hackathons

2016 | **Automated Library**, Microsoft Code.Fun.Do.
github

- Developed a Web Application in Django to catalogue bibliographies and library members for **Gymkhana library** and **Prayas** (a student endeavour to teach marginalized kids).

2017 | **QALearn**, Microsoft Code.Fun.Do.
github

- Developed a Web Application for **open-domain question answering** on ebooks using BiDAF model.