Varun Khare

Graduate Computer Science

vkkhare.github.io
varunkhare1234@gmail.com
github.com/vkkhare
+91-8717983153

ACADEMIC DETAILS

Examination	Institute	Year	CPI/%
Computer Science and Engineering	IIT Kanpur	2015-2019	8.8*
Class XII	Delhi Public School, Bhopal	2015	93.8*
Class X	Delhi Public School, Bhopal	2013	10.0*

* represents **distinction**

Relevant Courses:

Computer Vision$^+$
Bayesian Machine Learning
Learning Theory$^+$
Stochastic Processes
Introduction to Machine learning$^+$
Probability and Statistics$^+$
Computational Cognitive Science$^+$
Database Systems
Computer Networks$^+$

$^+$ is excellent performance

HONORS AND AWARDS

Fellowships	National Talent Search Examination (**NTSE**), 2013	Government of India
	Young Scientist Promotion Fellowship (**KVPY**) scholar, 2014	Government of India
Awards	Selected in **Top 15 teams worldwide**, Hack against Hunger(2018)	United Nations
	Most Innovative Student Activities (Depression therapy chatbot)	IITK newsletter
	Academic Excellence Award, 2015-2016	IIT Kanpur
	All-India Rank **40** amongst 1.5 million students	IIT-MAINS, 2015
	All-India Rank **192** amongst 150k students	IIT-JEE, 2015
	Scholarship (Complete fee-waiver) 2013	DPS Bhopal

WORK EXPERIENCE

- **Visiting Research Scholar** (Max Planck Institute for Brain Research, Frankfurt, Germany)
  (Guide: Prof. Moritz Helmstaedter, August'19 - January'20)
  - **Objective** : Myelin segmentation in 3D mSEM and connectomic analysis
  - We used **3D Unet** trained on multi **Scanning Electron Microscope** raw data to generate segmentation masks
  - Dynamically **oversampling** (with linearly decaying probability) myelinated voxel cubes to provide non-zero gradients countering **highly skewed** data (0.01% positively labeled voxels)
  - Reached over **90% precision-recall**. Using the detection to analyze thalamocortical neurons with myelinated axons at the beginning of innervation.
  - Also working on aligning mSEM scans of different brain tissue cuts by optical flow and anomaly detection

- **Visiting Research Scholar** (National University Singapore)
  (Guide: Prof. Tat Seng Chua, May'18 - July'18)
  - **Objective** : Monocular 3D object instance recognition and Pose Estimation
  - Worked (alongside a graduate student) on a novel end-to-end architecture consisting of two modules for robust pose prediction and instance recognition via extracting **Marr's 2.5 D sketches** from images.
  - The **learned embedding** explicitly **disentangles** a shape vector and a pose vector, which alleviates both pose bias for 3D shape retrieval and categorical bias for pose estimation
  - One sub module learns to **reconstruct 3D model**, from the 2.5D sketches, in its canonical viewpoint via **multi-task learning DNN**s. Another NN sub module uses **Faster R-CNN** style anchor boxes to predict the **6 DoF** poses in **continuous domain**.

- **Software Lead** (New York Office, IIT Kanpur)
  (Guide: Prof. Manindra Agarwal, May'16 - May'18)
  - **Objective** : Industrial grade deployment of ML backend and android application for NYO
  - **ML systems**: **Collaborative Filtering** for Recommendation engine; Automated response collection on scanned MCQ survey response sheets; **NLU chatbot** using **RASA** pipeline with **NER**, **Relationship extraction** and quantity association
  - **Android app**: REST APIs, SSE notifications, app-caching, Continuous integration with Jenkins, **data and property binding** and app designing
  - Lead a team of 16 people at NYO.

MAJOR PROJECTS

- **Zero-Shot Learning Framework** (Under Graduate Project)
  (Guide: Prof. Piyush Rai, Jan'18 - present)
  - Proposed a generative model for ZSL using **class conditional distributions** parametrized by non-linear functions of class attributes.
  - First work of its kind to propose an **adversarial domain adaptation** for minimizing the **domain shift** in Zero shot learning.
  - The generative model was trained using neural nets to model the class distributions resulting in **extensive hyper parameter stability**
  - The method achieved **state of the art accuracies** on benchmark datasets (AWA2, CUB and SUN). **First author paper** accepted at **WACV 2020** | *preprint*
- **Natural Language to SQL query**
  (Guide: self project, Sep'19 - Present)
  - **Objective** : generating SQL queries from natural language
  - Participating in **spider sql challenge** with current accuracy at 46%.
  - Proposed **transformer** based embeddings with an **abstract syntax tree** generator using **parent feeding LSTM cells**.
  - Encoder includes **Multi head relational attention** to associate database schema with question and a schema embedding to represent spatial structure of the database.
  - The decoder follows the Yin et. al. architecture while **biLSTM** is used to encode columns and tables in database.
- **Adversarial Corruption in deep Neural Networks**
  (Guide: Prof. Purushottam Kar, Jan'18 - April'18)
  - **Objective** : Provide a adversarial corruption factor for robustly training neural networks
  - Proposed an **alternating optimization** algorithm for the single layer Relu activated neural network. Converted the optimization problem to a **difference of convex functions** for robust optimization.
  - Practically compared the training procedure to SGD as a proof of concept.
  - Literature survey included robust statistics, convergence analysis of two layer network and various convergence proof techniques amongst others.
  - **Project Report:**
- **Concept-Graph based Word Problem solver** (Under Graduate Project)
  (Guide: Prof. Arnab Bhattacharya & Prof. Amay Karkare, July'17 - Dec'17)
  - **Objective** : Creating a solver for elementary speed, distance and time maths word problems
  - Generated **world concept graph** depicting **object-quantity** (like subject and distance) owner-ships, **value-quantity** associations (like 20kmph-speed) and relationships between subjects. Used **DFS** to traverse the graph and evaluate the answer for query.
  - Implemented the model using word2vec, **co-reference resolution**, **syntactic parsing** and **dependency parsing**
  - **Github** : github.com/varunkhare1234/word_problem_solver | **project report**
- **Augmented Reality Navigation** (Programming Club Project)
  (Guide: Self, May'16 - June'16)
  - Created **Android** navigation app using Google Directions API and **unity3d game engine**.
  - Relayed unity graphics on camera feed according to accelerometer and gyroscope readings. GPS and magnetic compass was used to detect roads.
  - Awarded **best club project** | : varunkhare1234/augmented-reality-app

TECHNICAL SKILLS

Languages	**Proficient**: C,C++, Java, Matlab/Octave, Bash, python, MySQL, LaTeX **Experienced**:Kotlin,R, Verilog, Assembly, C#, HTML
Softwares	**OS**: ARCH linux, Ubuntu, Windows **Libraries and Softwares**: Tensorflow, Pytorch, Android Studio, blender, Unity game engine

POSITION OF RESPONSIBILITY

Course Project Mentor	*Introduction To Machine Learning(CS771), IITK*	*(June'18-Nov'18)*
Coordinator	*Programming Club, IIT Kanpur*	*(May'17-March'18)*
Coordinator	*Google Developers Group*	*(May'16-April'17)*
Manager	*Software Corner, Techkriti 2017 (Annual Tech Fest)*	*(May'16-April'17)*
Student Guide	*Counselling service, IIT Kanpur*	*(June'16-April'17)*
Academic Mentor	*Counselling service, IIT Kanpur*	*(June'16-April'17)*
Senior Web Executive	*Antaragni 2016 (Annual Cult Fest)*	*(May'16-Nov'16)*
Senior Executive	*Entrepreneurship Cell, IIT Kanpur*	*(June'16-April'17)*
Secretary	*Programming Club, IIT Kanpur*	*(June'16-April'17)*