

Varun Khare

Graduate Computer Science

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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⁺

⁺ is excellent performance

Stochastic Processes

Introduction to Machine learning⁺

Probability and Statistics⁺

Computational Cognitive Science⁺

Database Systems

Computer Networks⁺

HONORS AND AWARDS

Fellowships	National Talent Search Examination (NTSE), 2013 Young Scientist Promotion Fellowship (KVPY) scholar, 2014	Government of India Government of India
Awards	Selected in Top 15 teams worldwide , Hack against Hunger(2018) Most Innovative Student Activities (Depression therapy chatbot) Academic Excellence Award , 2015-2016 All-India Rank 40 amongst 1.5 million students All-India Rank 192 amongst 150k students Scholarship (Complete fee-waiver) 2013	United Nations IITK newsletter IIT Kanpur IIT-MAINS, 2015 IIT-JEE, 2015 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.
- **Visiting Research Scholar** (National University Singapore)
(Guide: Prof. Tat Seng Chua, May'18 - July'18)
 - **Objective** : Monocular 3D object instance recognition and Pose Estimation
 - Proposed (alongside a graduate student) 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 DNNs**. Another NN sub module uses **Faster R-CNN** style anchor boxes to predict the **6 DoF** poses in **continuous domain**.
 - The method achieves state of the art **10.3 median error** for pose estimation and **0.592 top-1-accuracy** for **category agnostic 3D object retrieval** on the **Pascal3D+** dataset.
- **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](https://github.com/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	<i>Introduction To Machine Learning(CS771), IITK</i>	<i>(June'18-Nov'18)</i>
Coordinator	<i>Programming Club, IIT Kanpur</i>	<i>(May'17-March'18)</i>
Coordinator	<i>Google Developers Group</i>	<i>(May'16-April'17)</i>
Manager	<i>Software Corner, Techkriti 2017 (Annual Tech Fest)</i>	<i>(May'16-April'17)</i>
Student Guide	<i>Counselling service, IIT Kanpur</i>	<i>(June'16-April'17)</i>
Academic Mentor	<i>Counselling service, IIT Kanpur</i>	<i>(June'16-April'17)</i>
Senior Web Executive	<i>Antaragni 2016 (Annual Cult Fest)</i>	<i>(May'16-Nov'16)</i>
Senior Executive	<i>Entrepreneurship Cell, IIT Kanpur</i>	<i>(June'16-April'17)</i>
Secretary	<i>Programming Club, IIT Kanpur</i>	<i>(June'16-April'17)</i>