Varun Khare

Graduate Computer Science

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RESEARCH INTERESTS

Computer Vision	Privacy Preserving Machine Learning	Natural Language Processing
Cognitive Science	Distributed Computing	Program Synthesis

EDUCATION

Degree	Institute	Year	GPA
Bachelor of Technology	CSE, IIT Kanpur	2015-2019	8.8*/10
Senior Secondary	Delhi Public School, Bhopal	2015	93.8*/100
Secondary	Delhi Public School, Bhopal	2013	10.0*/10

* represents **distinction**

PUBLICATIONS

A Generative Framework for Zero Shot Learning with Adversarial Domain Adaptation *Arxiv*
Varun Khare*, Divyat Mahajan*, Homanga Bharadwaj, Vinay Kumar Verma, Piyush Rai*
Winter conference on Applications of Computer Vision (WACV), 2020

- Proposed a generative model for ZSL using **class conditional distributions** as non-linear functions of class attributes.
- First work to propose **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).

RESEARCH EXPERIENCE

June'20 - present **RESEARCH INTERN** *University of California, Berkeley, USA*

Advisor: Prof. Dawn Song
Objective : Neural symbolic hybrids for few shot recognition

- Using **program induction** to sample programs for **few shot image classification**.
- Training procedure involves Supervised pre-training with **teacher-forcing** followed by reinforcement learning using **Hindsight Experience Replay**.
- We use **memory augmented networks** with attention to allow multiple chains of execution.

Objective : Meta learning in SQL query synthesis

- Divided the Spider dataset into 13 meta categories.
- We use **transformers** to generate embeddings for natural language question tokens.
- A **meta-training phase** for decoder to learn predicting the **structure** of SQL query
- A **domain specific training** phase for token prediction using a separate multi head attention module.

Aug'19 - Mar'20 **VISITING RESEARCH SCHOLAR** *MPI for Brain Research, Frankfurt, Germany*

Advisor: Prof. Moritz Helmstaedter
Objective : Myelin segmentation in 3D mSEM and connectomic analysis

- multi **Scanning Electron Microscope** produces terabytes of data everyday making manual analysis impractical.
- Developed a **3D Unet-deeplab v3** hybrid to achieve over **97% accuracy** in 3D axon segmentation
- Responsible for data annotation, network design and distributed inference.
- The 3D segmentation masks are then **skeletonised** into connected components
- **First work** to successfully automate **Peta-Byte** scale axon detection in brain tissues

May'18 - July'18 **VISITING RESEARCH SCHOLAR** *National University of Singapore*

Advisor: Prof. Tat Seng Chua
Objective : Monocular 3D object instance recognition and Pose Estimation

- Worked (alongside a graduate student) on a novel end-to-end architecture which extracts **Marr's 2.5 D sketches** from images for **multi-task learning**.
- 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**

WORK EXPERIENCE

Oct'20 - present **FEDERATED LEARNING CAPABILITIES LEAD** *OpenMined*

Objective : open-source secure Federated Learning

- Vetting research projects in federated learning for deployment into OpenMined stack.
- Devising novel algorithms for **privacy preserving optimization** and **aggregation** in federated settings.
- Ongoing projects include **decentralized FL** and privacy-accuracy trade-offs in FL
- Leading a **multi-national team of 10** consisting of research scientists and engineers.

May'16 - May'18 **SOFTWARE LEAD** *New York Office, IIT Kanpur, India*

Advisor: Prof. Manindra Agarwal

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.

TALKS

Privacy Preserving On-Device Machine Learning with KotlinSyft *Talk*

Varun Khare *(Core Developer, Federated Learning Team Lead)*

OpenMined Privacy Conference (Pricon), 2020

- We built the world's first **open source ecosystem** for **differentially private federated learning**.
- The library supports **Peer-2-peer** communication for **secure aggregation** and other **SMPC** protocols.
- The talk gave a tutorial on deploying Federated Learning from scratch on android devices.
- Work funded by **PyTorch and RAAIS** foundation | Github : ***PyGrid***, ***KotlinSyft***

HONORS AND AWARDS

Fellowships	Pytorch-Openmined Fellow, 2020	RAAIS, Pytorch
	National Talent Search Examination (**NTSE**), 2013	Government of India
	Young Scientist Promotion Fellowship (**KVPY**) scholar, 2014	Government of India
Awards	**Top 14 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

TECHNICAL SKILLS AND COURSES

Languages	Proficient	C, C++, Kotlin, Java, Matlab/Octave, Bash, python, MySQL, LaTeX
	Experienced	R, Verilog, Assembly, C#, HTML, javascript
Softwares	OS	ARCH linux, Ubuntu, Windows
	Libraries and Utilities	Tensorflow, Pytorch, PySyft, pandas, seaborn, blender, SLURM
UG Courses	Machine Learning	Computer Vision$^+$, Learning Theory$^+$, Bayesian ML, Introduction to ML$^+$
	CSE	Computational Cognitive Science$^+$, Computer Networks$^+$, Statistical Processes

$^+$ **is excellent performance**

POSITION OF RESPONSIBILITY

Conference Volunteer	*International Conference on Learning Representations (ICLR)*	*(2020)*
Federated Learning Lead	*OpenMined*	*(Oct'20-present)*
Teaching Assistant	*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)*