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Shashank Shekhar

Education

University of Guelph — Guelph, Canada
Masters, Electrical & Computer Engineering: Artificial Intelligence — Sep 2019 - Jan 2022
Thesis: Inductive Biases For Higher-Order Visual Cognition

Indian Institute Of Technology — Dhanbad, India
Bachelors, Electronics & Communication Engineering — Jul 2013 - May 2017

Skills

- **Languages:** Python, C++, C (advanced) MATLAB (intermediate), Julia, JavaScript (beginner)
- **ML Frameworks:** PyTorch, PyTorch Lightning, TensorFlow, OpenCV, VISSL
- **Dev tools:** VS-Code, Jupyter Notebook, Jupyter Lab, Hydra
- **DevOps:** Git, JIRA, Travis CI, GitHub Actions
- **Cloud:** AWS Sagemaker, AWS Rekognition, AWS Lambda, Google Vision OCR, Google Doc AI
- **High Performance Computing:** SLURM, SubmitIt, Numba
- **Web Development:** Jekyll, Hugo, Bootstrap, Flask (all beginner)

Experience

Meta (Facebook) AI — Menlo Park, California
AI Resident | Advisor: Dr. Ari Morcos — Sep 2021 - Present

- Ongoing research on large-scale computer vision with dataset sizes of 10+ million images.
- Providing engineering support to Facebook's libraries on self-supervised learning, job scheduling on clusters, and configuration management.

NEXT AI — Toronto, Canada
Scientist in residence (consultant) — March 2021 – Sep 2021

- Prototyped an OCR and object detection framework for CAD designs which improved detection accuracy by 50% on commercial data.
- Developed Python wrappers for a RESTful API to ingest large (100+ GB) geo-spatial image data.

Machine Learning Research Lab, University of Guelph — Guelph, Canada
Graduate Research Assistant | Advisor: Prof. Graham Taylor — Jan 2020 - Oct 2021

- Implemented and Profiled Convolution Neural Networks with a dynamically inferred graph for each batch sample using Pytorch's DataParallel API and low-level tensor operations.
- Published 4 research papers (3 as lead author) on explainable AI and visual reasoning.

deeplearning.ai — Remote
Deep Learning Content Engineer — April 2019 – June 2019

- Maintained Tensorflow assignments & Docker based auto-graders for the Stanford CS230 and Coursera Deep Learning specialization taken by over 1.2 million students and rated 4.8/5.

Shell R&D, Hyperworks Imaging — Bangalore, India
Research Associate (collaboration through IISc Bangalore) — March 2018 – April 2019

- Implemented image denoising, contrast enhancement, and segmentation algorithms for 3D μ-CT digital rock images in MATLAB, C++ which increased analysis speeds by over 3X.
- Collaborated on a video person detection and re-id system using Faster R-CNN and Attention networks across 6 cameras, delivering over 80% accuracy in highly congested urban indoor environments.

Visual Computing Lab, Indian Institute of Science — Bangalore, India
Research Assistant | Advisor: Prof. Anirban Chakraborty — Jan 2018 - April 2019

- Prepared, released, and developed multi-modal models for the first large-scale dataset (250k images, 1.3M Q-A pairs) on Visual Question Answering with a knowledge graph and scene text OCR.
- Developed a PyQT based GUI for ranking image retrieval results for labelling and human validation.
- Published 4 peer-reviwed papers (1 as lead author) on object detection, re-identification, and question answering.

Samsung Research Institute — New Delhi, India
Software Development Engineer — July 2017 – Jan 2018

• Wrote middleware and DPI integrations for video streaming applications (Netflix, Amazon Prime Video) for Samsung Smart TV's Linux OS using gstreamer in C++.

Publications

(* denotes lead author)

Neural Structure Mapping For Learning Abstract Visual Analogies*
SVRHM 2021 Workshop @ NeurIPS

Context-aware Scene Graph Generation with Seq2Seq Transformers [paper] [code]
ICCV 2021

Neural Response Time Analysis: XAI Using Only a Stopwatch* [paper]
Applied AI Letters

Response Time Analysis for Explainability of Visual Processing in CNNs* [paper] [video]
CVPR 2020 Minds vs Machines workshop *(Among 3 oral presentations)*

From Strings to Things: Knowledge-Enabled VQA Model That Can Read And Reason [paper] [webpage]
ICCV 2019 *(Oral: 4.3% acceptance rate)*

OCR-VQA : Visual Question Answering By Reading Text In Images [paper] [webpage]
ICDAR 2019

Operator-In-The-Loop Deep Sequential Multi-camera Feature Fusion for Person Re-Id [paper]
IEEE TIFS (volume 15)

Road Damage Detection & Classification In Smartphone Images Using Mask R-CNN* [paper] [code]
IEEE BigData 2018 Challenge

Projects

miniTorch *(Python: Numpy, Numba, Hypothesis)*
• Functional machine learning library that implements tensor operations and auto-differentiation.
• Native support for PyTorch code and execution on CUDA processors.

Nand2Tetris *(HDL, Assembly)*
• 16-bit computer simulator implemented from scratch.
• Developed logic gates, adders, ALU, program counter, memory, CPU & assembler based on op-code instruction set.

implicit MAML *(Python: PyTorch, Torchmeta, Higher)*
• Performed meta learning with implicit gradients for few-shot image recognition on Ominglot dataset.

microBLAS *(C)*
• Efficient linear algebra routines library for vector, matrix and sparse matrix operations.
• Supports Eigen vectors, SVD, QR and Cholesky factorization, least squares, Gaussian elimination, etc.

RBDoom *(Python: PyTorch, VizDoom)*
• Game-playing AI using RAINBOW algorithm for deep reinforcement learning.
• Learn a controller for playing FPS game Doom directly from image pixels in simulator.

cmGAN *(Python: PyTorch)*
• Cross-Modal Generative Adversarial Networks to perform visual re-identification across RGB and Infrared image modalities.

Kaggle Projects
• Implemented "Bi-Linear CNNs for Fine-grained Visual Recognition" to perform image classification of fashion products and home goods (Top 10% of 638 participants).
• Implemented LSTM, GRU, Attention Networks using word embeddings from Glove and FastText to perform toxic comment classification (Top 25% of 4539 participants).

Awards

- Vector Institute Research Grant 2020-21
- Conference on Neural Information Processing Systems (NeurIPS) 2019 Travel Grant
- International Conference on Computer Vision (ICCV) 2019 Student Volunteer Award & Travel Grant
- JN Tata Endowment for Higher Education of Indians & Travel Grant 2019
- Vector Institute Scholarship in Artificial Intelligence 2019
- Machine Learning Summer School (MLSS) London 2019 full scholarship

Invited Talks

- **Analogical Minds Seminar:** Implementing structure mapping as a prior in deep learning models for abstract reasoning [video] March 2022
- **University of Toronto Machine Intelligence Group:** Breaking into AI: Industry Speaker Panel [video] November 2021

Service

- **Conference Reviewer:** ICLR 2022, CVPR 2022, ECCV 2022
- **Journal Reviewer:** Applied AI Letters

Teaching and Mentoring

Mentor, ProjectX: Student Competition, Cornell University Fall 2021, Winter 2022
- Team won the grand $25,000 prize for predicting spread of COVID-19 misinformation from tweets

GTA, ENGG 3130: Modelling Complex Systems, University of Guelph Winter 2021
- Coursework on graph theory, automata, game theory, agent-based models. Labs in Python (Jupyter Lab, NetworkX, Numpy) and course notes development using Restructured Text.

Lecturer, LearnAI: Intro to Artificial Intelligence, University of Toronto Fall 2020
- Coursework on scientific python, data analysis, machine learning, computer vision, natural language processing. Labs in Python (Numpy, Pandas, Scikit Learn, Keras).

GTA, ENGG 3700: Optimization, University of Guelph Fall 2020
- Coursework on linear optimization. Labs in Excel Solver.

GTA, ENGG 1500: Engineering Analysis, University of Guelph Winter 2020
- Coursework on introduction to linear algebra. Labs in MATLAB.

Community TA, Machine Learning, Coursera Fall 2018, Winter 2019
- Coursework on introduction to machine learning. Labs in MATLAB.

Relevant Coursework

- **UoGuelph:** Machine Learning, Computational Thinking For AI, Scientific Computing, Optimization, Computational Statistical Inference, Natural Language Processing, Information Theory
- **Online:** Deep Learning, Mathematics for Machine Learning, Reinforcement Learning
- **Summer Schools:** Machine Learning Summer School London 2019, DeepBayes 2019: Bayesian Methods for Deep Learning, CIFAR Deep Learning and Reinforcement Learning 2020, MIT-Harvard Brains, Minds and Machines 2020