Aayush Prakash

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Education

University of Waterloo — Waterloo, ON
M.A.Sc., Computer Engineering — *2010–2013*

Indian Institute of Technology(IIT) — Kharagpur, India
B.Tech(Hons)., Electronics & Electrical Communication Engineering — *2006–2010*

Scholastic Achievements

- Among **top 0.1 %** in IIT-JEE 2006. Secured a rank of 382 out of 300,000 candidates over India.
- Achieved a rank of 603 in AIEEE 2006 among 400,000 applicants all over the country.

Work Experience

Senior Deep Learning Researcher — Toronto, ON
Toronto AI Lab lead by Prof. Sanja Fidler, **NVIDIA** — *2015–Present*

- Introduced Meta-Sim a novel technique to automatically generate synthetic worlds which match target dataset and are also optimized for downstream tasks. **Featured in OpenAI** blog and talk.
- Proposed Domain Randomization as a technique for training computer vision models. Recognized by MIT as a **breakthrough** developments of 2017-2018 in Deep Learning. Selected as **top 10** coolest work of CVPR 2018 by TowardsDataScience.
- Proposed Structured Domain Randomization, a variant of Domain Randomization for training state of the art Sim-to-Real object detection models. This work featured in TowardsDataScience.
- Other prior work includes Game Emulation which featured in Endgaget.

Staff Software Developer — Markham, ON
Optimization team, **IBM Canada Lab** — *2013– 2015*

- Lead JIT (Just in Time Compiler for Java 8) research and development of loop optimizations including implicit loop auto-parallelization on GPU & SIMD platforms, loop versioning, etc . Made significant performance impact on IBM's products. The code is open sourced.

Skills

Languages: C, C++, Python, Java, CUDA, ARM assembly.

Framework: PyTorch, Theano, TensorFlow, GDB, PVS Theorem Prover.

Selected Publications

- Meta-Sim: Learning to Generate Synthetic Datasets. *Amlan Kar, Aayush Prakash, Ming-Yu Liu, Eric Cameracci, Justin Yuan, Matt Rusiniak, David Acuna, Antonio Torralba, Sanja Fidler.* ICCV 2019 (Oral) [25 citations]
- Structured Domain Randomization: Bridging the Reality Gap by Context-Aware Synthetic Data. *Aayush Prakash, Shaad Boochoon, Mark Brophy, David Acuna, Eric Cameracci, Gavriel State, Omer Shapira, Stan Birchfield.* ICRA 2019 [41 citations].
- Training Deep Networks with Synthetic Data: Bridging the Reality Gap by Domain Randomization. *Aayush Prakash*, Jonathan Tremblay* , David Acuna*, Mark Brophy*, Varun Jampani, Cem Anil, Thang To, Eric Cameracci, Shaad Boochoon, Stan Birchfield.* CVPR Autonomous Driving Workshop 2018 [201 citations].

- An Instruction Scratchpad Memory Allocation for the Precision Timed Architecture. *Aayush Prakash, Hiren D Patel* IEEE Transactions on CAD, 2013 [17 citations].
- Parallel Simulation of Mixed-abstraction SystemC Models on GPUs and Multicore CPUs. *Rohit Sinha, Aayush Prakash, Hiren D Patel*. ASPDAC 2012 [59 citations].

Academic Research Projects

Instruction allocation to SPM for PRET architecture Waterloo, ON
under Prof. Hiren D. Patel, University of Waterloo *2010–2012*

- Memory allocation scheme for fast on-chip memories like scratch-pad memory (SPM) with the objective to meet timing deadlines. Wrote a Java based ARM binary instrumentation tool that parses and rewrites the binary by representing it as a control flow graph.

Parallel Simulation of SystemC Models on Muticore CPUs and GPUs Waterloo, ON
under Prof. Hiren D. Patel, University of Waterloo *2011– 2012*

- The SystemC threads with data parallel computation, are allowed to execute on GPUS with support for SystemC on GPU and CPU-GPU communication. Achieved a 30x performance gain over sequential SystemC simulation. Worked on SystemC to CUDA translator.

Object Categorization Graz, Austria
under Prof. Axel Pinz, Graz University of Technology *Summer 2009*

- Worked on object categorization and shape matching of objects in noisy images. Proposed novel measures of Orientation and Clutter for object categorization.

Multi-Camera Surveillance Haifa, Israel
under Prof. Ilan Shimshoni, University of Haifa *Summer 2008*

- Identified the camera network topology in a multi-camera surveillance system. Proposed method that utilized background subtraction algorithm (codebook algorithm) to detect motion followed by SPRT (hypothesis test) to check the coherency of the motion.

3D Image Retrieval Kharagpur, India
under Prof. P.K. Biswas, Dept. of E&ECE, IIT Kharagpur, India *2009–2010*

- Proposed a novel way of 3D image retrieval by extracting descriptors from the 2D projections of 3D. These descriptors are clustered to obtain features which could match the 2D projections effectively and further provide hierarchical rank to each database image relative to the query image.

Patents

- Learning to Generate Synthetic Datasets for Training Neural Networks *Amlan Kar, Aayush Prakash, Ming-Yu Liu, David Jesus Acuna Marrero, Antonio Torralba Barriuso, Sanja Fidler*. US Patent App. 16/685,795.
- Generation of Synthetic Images For Training a Neural Network Model. *Jonathan Tremblay, Aayush Prakash, Mark A Brophy, Varun Jampani, Cem Anil, Stanley Thomas Birchfield, Thang Hong To, David Jesus Acuna Marrero*, US Patent App. 16/256,820.

Awards

From University of Waterloo, Canada:

- Graduate Scholarship in Fall 2011.
- Graduate Research Studentship for the year 2010-2102.
- International Masters Award for the year 2010-212.
- Indian Institute of Technology scholarship for the year 2010-2012.

From Indian Institute of Technology (IIT) Kharagpur, India:

- MCM scholarship for the year 2009-2010.