SAYANTAN DATTA
PhD Student,
Graphics and Imaging Lab, McGill University.
Supervisor: Prof. [Derek Nowrouzezahrai](#)

Email : sayantan.datta@mail.mcgill.ca
Website : **[sayan1an.github.io](#)**
Phone : +1-438-927-8533

Research Interests

My primary research interest intersects real-time rendering and Machine Learning.

Peer reviewed articles

Neural Shadow Mapping, Siggraph Conference Proceedings, 2022 ([Link](#))
Adaptive Dynamic Global Illumination, High Performance Graphics Posters, 2022 ([Link](#))
Subspace Neural Physics: Fast Data-Driven Interactive Simulation, Symposium of Computer Animation, 2019 ([Link](#))

Work : Non-academic

- Oct, 2022 - Mar, 2023 - Research Scientist Intern - Meta Reality Labs (Redmond, WA, USA)
- Apr, 2022 - Jun, 2022 - Research Intern - Nvidia Research (Santa Clara, CA, USA)
- Aug, 2021 - Mar, 2022 - Sr. Researcher Intern - Huawei CG Labs (Vancouver, BC, Canada)
- Jan, 2021 - Jul, 2021 - Research Scientist Intern - Meta Reality Labs (Redmond, WA, USA)
- Jan, 2018 - Apr, 2018 - Animation Programmer Intern (Research) - Ubisoft LaForge (Montreal, QC, Canada)
- Sep, 2013 - Aug, 2016 - Assistant Engineer - Damodar Valley Corporation (Kolkata, India)
- Jul, 2013 - Sep, 2013 - Student contributor - Google summer of code (Kolkata, India)

Work : Academic

- McGill Teaching Assistantships (2016-2020) - ECSE443 (Numerical Methods in Electrical Engineering), COMP250 (Intro to Computer Science), COMP559 (Computer Animation), COMP202 (Intro to Programming), ECSE222 (Digital Logic), COMP310 (Operating Systems)

Projects

- Oct, 2022 - Present: Low power shading and texturing, Meta Reality Labs Research - Graphics.
    - We are exploring architectures suitable for low power direct illumination shading. Some questions we are trying to answer are - whether ML accelerators are efficient for shading, whether replacing compute with memory is useful, whether there are any advantages to using Neural techniques for real-time texture compression.

- Apr, 2022 - Jun, 2022: Capturing dynamic content using *Instant-NGP,* Nvidia Research.
    - Neural Radiance Field (NeRF) based techniques are suitable for novel view synthesis of static 3D content. Armed with fast training times, we explored whether *Instant-NGP* is suitable for real-time view synthesis of a dynamic scene captured live from a few camera angles.

- Aug, 2021 - Feb, 2022: Scaling DDGI for large scenes and dynamic objects, Huawei Vancouver.
    - Probe based Global Illumination techniques such as DDGI are popular among real-time renderers due to their performance, temporal stability and simplicity. However, they lack scalability and better support for

dynamic content. Our work is aimed at improving the scalability and dynamism using a novel sampling scheme tailored for this purpose.
- ○ Practical experience: Vulkan/DX12

- ● Jan, 2021 - July, 2021: Hard and soft shadows for low powered devices, Facebook Reality Labs.
  - ○ Rendering hard and soft shadows without ray-tracing has been a longstanding problem. We trained a machine learning filter that works as a post-processing step atop a standard shadow-mapping pass. Our model can generate high-fidelity hard shadows and plausible soft shadows in real time without ray-tracing.
  - ○ Practical experience : Writing Falcor renderpasses, implementing neural network inference in CUDA + Falcor, writing data collection scripts with Falcor, network training on GPU clusters.

- ● 2018-2020:
  - ○ Build and maintain a [Vulkan based hybrid raytracing + rasterization engine](#) for prototyping real-time raytracing projects.
  - ○ Implement various technical papers on distribution effects, filtering and advanced MC sampling using Mitsuba.
  - ○ Prototyping ideas in a 2D Flatland raytracer.

- ● 2017 - 2018 : Numerical Study of Frictional Contact, Master's Thesis Project.
  - ○ We developed a high quality soft body contact simulator taking into account surface roughness and elastic parameters and use the data obtained to train a regressor, eliminating the need for slow costly computations.
  - ○ Theory : Finite element modeling, elasticity theory and damping, modal analysis, collision detection.
  - ○ Practice : Writing high performance SIMD (targeting SSE2 and AVX) code in C++ for VC and gcc compiler, C++ threading, finding workaround for linux kernel bugs, dealing with frustration and more.

- ● 2017 - 2018 : Accelerating cloth simulation using latent space dynamics, Ubisoft Montreal.
  - ○ Explored various strategies for compressing the data and time integration in latent space. Tested different Neural network architectures, and evaluated their runtime performance in C++.
  - ○ Worked on integrating C++ Machine Learning inference with Ubisoft production physics engine.
  - ○ Collecting animation data using 3DS max and Ubisoft cloth plugin - used Maxscript and C++.
  - ○ Comparison with other state of the art cloth simulator.
  - ○ Implemented Recurrent Network Architecture in C++.

- ● 2014 - 2016 : Full stack developer for building Business Application (No longer interested in this track).
  - ○ Worked with databases PL/SQL and JDBC.
  - ○ Server side processing using Java Server Pages and Struts MVC framework.
  - ○ Client side processing using Javascript.

- ● 2012 - 2016 : Accelerating cryptographic hashes using GPU in [John-The-Ripper](#) password security auditing tool.
  - ○ Implemented the now popular "[Mask mode](#)" for password generation on GPU.
  - ○ Implemented [Perfect Hash Table](#) for detecting hash collisions on GPU.
  - ○ Writing and maintaining GPU kernels for various cryptographic hash functions such as MsCash2, MD5, BCrypt etc.

Education

McGill University	PhD, Elec. and Computer Engg.	Sept 2018 - Present	N/A
McGill University	MSc, Computer Science-Thesis	Sept 2016 - Dec 2018	GPA : 4.0/ 4.0
NIT, Durgapur, India	B.Tech, Electronics and Comm.	July 2009 - July 2013	GPA : 8.91/10

Scholarships

- Fonds de Recherche du Québec – Nature et technologies, 2020
- McGill International Tuition Fee Waiver, 2020
- McGill MEITA Scholarship, 2018
- Pierre Arbour Foundation Scholarship, 2017

Skills

Languages: *C, C++, Python, Java, Javascript.*
APIs: *Vulkan, D3D12, OpenCL, CUDA, PyTorch*

Class projects and short projects

- Reinforced ray-tracing : McGill RL - Implemented a ray-tracer in Nori where the direction of next ray is learnt online using RL. Used C++, Intel TBB for multithreaded updates to the Q-function.
- Real time rigid body simulation using GPUs : McGill Comp Animation - Implemented Projected Gauss Seidel (CPU) and Projected Jacobi (GPU) solvers for rigid body contacts. Used Ogre3d, Bullet SDK and OpenCL.
- Ray-tracing engine: McGill Image Synthesis : Implementing BVH, various importance sampling schemes, environment maps, light sources, brdfs, implementation of paper "Linearly Transformed Cosines".

Volunteer Experience:

- Member of student and postdoctoral advisory committee in [CS-CAN](CS-CAN) in 2018-2019.
- Selected as a student volunteer at Siggraph Los Angeles 2017.
- Selected as a Micro Observer to facilitate the General Assembly Election on 21st April 2016 in India.
- Selected as a TA for Coursera Heterogeneous Parallel Programming course, January 2014.
- Open-source developer for John-The-Ripper password security auditing tool for 3 years.

Extra coursework (MOOCs):

- Programming/HPC : Coursera: Heterogeneous Parallel Programming, 2013 and 2014, Coursera: Algorithm Design and Analysis, Coursera: Compilers, Coursera: Hardware Software Interface.
- Math/ML : Coursera : Bayesian method for ML, Udacity : Reinforcement Learning, Youtube : Stephen Boyd Convex Optimization, Coursera: Machine Learning, edX : Intro to Probability and Statistics, MIT 18.02 (Multivariate calculus), MIT 18.06 (Linear Algebra), Youtube : Pavel Grinfeld Tensor Calculus.
- edX: Foundations of Computer Graphics, UC Berkeley.

Other Achievements:

- 97.25% Aggregate in Sciences + Mathematics in Senior School Exam, 2009.
- Rank 5th in Indian Junior Mathematics Olympiad 2006.