Simon Solca

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Education

University of Cambridge, MEng in Computer Science Oct 2023 – July 2027

- Achieved second-year grade of 2:1
- **Modules:** Advanced Graphics and Image Processing, and Cloud Computing
- **Courses:** Machine Learning and Real-World Data, Probability, Data Science, Logic and Proof, Scientific Computing, Concurrent Systems, Computation and Complexity Theory
- **Dissertation:** Real-time ray tracing using ReSTIR, with a focus on reducing variance discrepancy between displays in VR headsets using statistical methods to improve viewing comfort. (in progress)

Projects

Differential Analyser Simulation differentialanalyser.github.io

- Co-developed an open-source simulation of a differential analyser, solving differential equations numerically.
- Derived the mathematics of the physical system and proved correct by creating a prototype engine.
- Redesigned and optimised the core engine to improve numerical stability and performance, reducing residual errors in the simulations by a factor of 1000.
- Awarded the 'Most Impressive Professional Achievement' by the department, runner-up for 'Most Impressive Technical Achievement', and featured in the IEEE Annals of the History of Computing.

Offline CUDA Path Tracer

- Built a high-performance offline renderer on the GPU using CUDA, applying quasi-Monte Carlo methods to reduce variance in stochastic sampling.
- Designed and implemented custom heuristics for acceleration data structures, optimising performance to within 10% of state-of-the-art methods in most cases, and out-performing them in specific benchmarks.
- Reduced branch divergence and cache misses by grouping and reordering rays with similar properties, ensuring thread blocks processed uniform tasks simultaneously.

Monte Carlo Markov Chain Parameter Calibration for the Heston Model

- Implemented and calibrated the Heston stochastic volatility model for option pricing.
- Applied Monte Carlo Markov Chain (MCMC) methods to fit parameters of the Heston model to historic data.
- Analysed convergence rates, posterior distributions, and sensitivities, benchmarking MCMC calibration against standard least-squares methods.
- Simulated option price paths to validate results and generated implied volatility surfaces.

Skills

Maths: Monte Carlo methods, stochastic processes, numerical methods and optimisation, probability theory
Languages: C++, C, CUDA, Java, Python, OCaml

Experience

Private Maths and Computer Science Tutor

- Tutored data structures, algorithms, and complex mathematical concepts to university-level students.
- Guided a private A-level maths candidate, from a predicted D to an achieved A.
- Assisted students with university entrance exams, STEP, TMUA, and MAT.

Hobbies, Interests

Chess, Cryptography and Ciphers, Math and Logic Puzzles, Advent of Code (Multiple top 100 finishes)