

# Akarsh Simha

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Work Authorization: U.S. Green Card

## Education

### The University of Texas at Austin

*Ph.D. in Physics, 3.87/4*

**Austin, TX, USA**

*2010 – 2017*

### Indian Institute of Technology Madras

*B.Tech. in Engineering Physics, 8.52/10*

Minor: Theoretical Computer Science

**Chennai, India**

*2006 – 2010*

## Relevant Experience

Over six years at Apple, Inc. in a machine learning team, I made major technical contributions to several flagship ML-powered features delivered on iOS and macOS. I had opportunities to work across the entire machine learning stack – training infrastructure and compilers, formulating and achieving data requirements, building data pipelines, training and tuning neural networks, evaluating model performance in the real world, and deploying them on resource-constrained hardware. I am a fast learner with a broad base that can tackle a variety of complex problems. I contribute to an open-source astronomy project in my spare time.

### Apple Inc.

*Senior Machine Learning Research Engineer*

**Cupertino, CA**

*October 2022 – November 2023*

- Designed and implemented a C++/Objective-C framework to deploy machine learning models on mobile devices
- Developed robust API interfaces, working with client teams to ensure they were easy to use
- Optimized memory and compute performance of pre-processing, model execution and post-processing pipelines
- Achieved over 50% reduction in storage footprint of model metadata such as classifier labels and associated information by developing better encoding schemes
- Implemented optimal graph algorithms to execute model post-processing steps, reducing runtime

*Machine Learning Research Engineer*

*September 2019 – October 2022*

- Formulated data requirements for computer vision problems with ambiguous and complex decision boundaries
- Iterated with data annotation teams to achieve the desired ground truth labels on edge cases
- Developed code for training neural-network models, contributed to training frameworks
- Ran model training experiments and hyperparameter searches, evaluating models on key metrics
- Identified the key performance metrics for a given problem and selected models by evaluating them on real-world datasets, tuning thresholds based on precision-recall tradeoffs
- Performed robustness/failure analysis to prepare models for the real world
- Models I developed were shipped in flagship iOS features such as [salient object segmentation](#) and [detecting undesirable assets for photo library syndication](#)
- A 3-month rotation in a team working on optimization passes for an LLVM-based GPU driver, with impact on real-world shader performance on Apple GPUs. I improved optimization passes at the level of LLVM IR as well as in instruction selection

*Machine Learning Compilers and Systems Engineer*

*October 2017 – September 2019*

- Key contributor to a deterministic ML compiler system for rapid prototyping of ML models
- Implemented code to emit C-code, LLVM IR, and CUDA kernels for neural-network operators
- Hand-crafted CUDA kernels for operations such as deterministic parallel cumulative sum and a spatial transformer network layer
- Trained and tuned a next-generation face recognition model as a proof-of-concept for the compiler
- Conceived, developed and deployed a model-in-the-loop data annotation tool, working with data annotators to improve usability to ensure fast turnaround of annotated datasets

### Google Summer of Code

*Mentor for The KDE Project*

**Remote**

*Summers of 2009 – 2013, 2015 – 2016*

Mentored/Co-mentored many students working on GSoC projects with [KStars](#), an open-source astronomy software under [KDE](#).

- Laid out project ideas for students, provided software design guidance and performed code reviews
- Projects supervised include: an improved GUI for astronomical observation planning, a relational database for storing astronomical data, using OpenGL for drawing, and optimization of the computation pipeline in KStars

*Student Developer for The KDE Project*

*June – August 2008*

- Used a space-partitioning tree and LRU cache to render a 100 million star catalog in the astronomy software [KStars](#) using less than 200MB of total memory at any given time
- Implemented an optimized binary data format for fast lookup of stars in a spatial region compressing the whole catalog into 1.4GB

## The KDE Project

*Volunteer Open-Source Contributor*

*Ongoing Involvement*

Contributor to KStars, cross-platform open-source astronomy software written using C++ and Qt

- Reduced the time taken to compute celestial object positions by 45% by caching expensive trigonometric computations
- Improved the performance and accuracy of core positional-astronomy routines and introduced rigorous tests against IAU standards
- Currently working on cross-matching, ingesting and rendering a 300 million star database without compromising memory and CPU usage

## The University of Texas at Austin

**Austin, TX**

*Graduate Student Researcher*

*June 2011 – August 2017*

Key part of a team that succeeded in making a measurement of Brownian motion with unprecedented temporal and spatial resolution

- Used optical tweezers to track a few-micron-sized particle in liquid to verify the tenets of statistical physics by directly measuring the particle's microscopic motion. The results were published in the prestigious *Science* journal
- Developed a software system to aid with alignment of crucial optical elements, and for characterizing the frequency response of photodetectors, thereby removing system artifacts from the data
- Developed a new mathematical framework to approximate solutions to the equations of fluid mechanics in various geometries, bringing mathematical rigor to a previously ad-hoc approximation method
- Skills acquired include optics, interfacing with hardware, software engineering, design and development of electronics, mathematical modeling

## Patents

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- US-20220382803-A1: Syndication of Secondary Digital Assets with Photo Library

## Selected Publications

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- [Observation of Brownian Motion in Liquids at Short Times: Instantaneous Velocity and Memory Loss](#)  
S. Kheifets, [A. Simha](#), K. Melin, T. Li, M. G. Raizen; **Science** 28, Vol. 343 No. 6178 pp. 1493-1496 (2014)
- [Unsteady Stokes flow near boundaries: the point-particle approximation and the method of reflections](#)  
[A. Simha](#), J. Mo, P. J. Morrison; **J. Fluid Mech.**, Vol. 841, pp. 883–924 (2018)
- [An algebra and trigonometry-based proof of Kepler's First Law](#)  
[A. Simha](#); **Am. J. Phys.**, Vol. 89, Issue 11, pp. 1009-1011 (2021)

## Relevant Skills

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*Proficient:* C++17, Python (numpy, Flask, tensorflow), Linux, git, Deep Learning, Computer Vision, Applied Math  
*Working Knowledge:* LLVM, bash scripting, CMake, CUDA, HTML/CSS/JavaScript

## Selected Coursework

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**Graduate:** Quantum Mechanics, Nonlinear Dynamics, Quantum Optics, Complex Analysis, PDEs

**Undergraduate:** Algorithmic Graph Theory, Quantum Information and Computing, Formal Logic, Formal Languages