

# Alex Bowe, PhD

Senior Software Engineer and Algorithm Researcher specializing in Compression, Information Retrieval, and AI Planning  
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## WORK EXPERIENCE

### Senior Software Engineer, Route Planning, AI | Cruise, San Francisco, CA

Dec 2018 – Oct 2023

- Owner of internal Python library abstracting on-car router, empowering 100s of staff in automated analysis; designed API, managed releases, and achieved 94% test coverage, supported via extensive docs, tutorials, and office hours
- Co-architected and implemented modular fleet-wide intelligence sharing system, enabling real-time responses to city-wide events, reducing vehicle recovery incidents by 20% and remote operator calls by 5%
- Spearheaded cross-functional task force of 6 to resolve a complex fire-up issue in less than 24 hours, saving the company millions and securing 90-day GTM targets. Authored playbook to prevent recurrence
- Revamped router architecture using the builder pattern, supporting high frequency lazy updates and cached subcomponents, simplifying usage, improving speed, reducing bugs, and removing 1000s of lines of code
- Partnered with Data Science team to establish automated training and delivery of weekly traffic model, improving ETA accuracy by 17%
- Initiated cross-functional effort to implement route-aware pullover suggestion system, yielding 17% improvement to both ETA and customer wait times
- Mentored and paired with 12 engineers and interns on research projects, leading one intern to receive a patent

### Software Engineer, Route Planning, AI | Cruise, San Francisco, CA

Mar 2017 – Nov 2018

- One of the first 100 engineers; instrumental in engineering fine-tuned route planning controls, such as avoidance and attraction areas, reducing takeovers and directly contributing to receiving over \$2B during early investor demos
- Partnered with all engineering team leads to define key routing metrics and built tools for daily prediction and monitoring of real-world performance to guide company-wide development
- Accelerated development feedback cycle by collaborating with the simulation team to fully integrate, control, and visualize the router within simulations
- Engineered global pullover interval index, reducing vehicle recovery incidents caused by being stuck while searching for free space, and facilitating future safety and comfort criteria expansion

### Algorithms Research Consultant

Oct 2013 – Aug 2015

- Increased genetic database capacity by 150% using succinct indexes, reporting directly to CTO of One Codex
- Improved quantum DNA sequencer recall by 7% using k-means, reporting directly to CTO of Quantum Biosystems

## PATENTS

- *Real time AV fleet parking availability*, co-inventor, pending, 2023
- *System-level optimization and mode suggestion platform for transportation trips*, primary inventor, pending, 2023
- *Systems and methods for overlap-aware ranking of navigation avoidance areas for autonomous vehicles*, primary inventor, [US11307590B2](https://patents.google.com/patent/US11307590B2), 2022
- *Analysis of network effects of avoidance areas on routing*, co-inventor, [US10962380B2](https://patents.google.com/patent/US10962380B2), 2021

## PUBLICATIONS

\* indicates primary authorship

- M. Muggli\*, A. Bowe\*, N. Noyes, P. Morley, K. Belk, R. Raymond, T. Gagie, S. Puglisi, C. Boucher, *Succinct colored de Bruijn graphs*, *Bioinformatics*, [10.1093/bioinformatics/btx067](https://doi.org/10.1093/bioinformatics/btx067), 2017
- C. Boucher, A. Bowe, T. Gagie, G. Manzini, J. Sirén\*, *Relative select*, *String Processing and Information Retrieval: 22nd International Symposium*, [10.1007/978-3-319-23826-5\\_15](https://doi.org/10.1007/978-3-319-23826-5_15), 2015
- C. Boucher, A. Bowe\*, T. Gagie, S. Puglisi\*, K. Sadakane, *Variable-order de Bruijn graphs*, *Data Compression Conference*, [10.1109/DCC.2015.70](https://doi.org/10.1109/DCC.2015.70), 2015
- A. Bowe\*, T. Onodera, K. Sadakane\*, T. Shibuya, *Succinct de Bruijn graphs*, *International Workshop on Algorithms in Bioinformatics*, [10.1007/978-3-642-33122-0\\_18](https://doi.org/10.1007/978-3-642-33122-0_18), 2012

## EDUCATION

**PhD in CS (Bioinformatics) | National Institute of Informatics, Tokyo, JP | GPA 4.0** **Mar 2020**

- Co-invented compressed suffix array-based DNA graph, reducing memory requirements by 93%, enabling complex analysis on commodity hardware at home or in the field (utilized in COVID-19 vaccine - source: [10.3390/v15051065](https://doi.org/10.3390/v15051065))
- Co-invented variable-order DNA graph, supporting context window adjustment on-the-fly at marginal cost to performance. Later research built off of this to improve DNA sequencing accuracy to near-optimal levels
- Co-invented compressed colored DNA graph, enabling large scale population genomics such as rapid detection of all Antimicrobial Resistance Genes in food supply chains, preventing epidemics
- Designed and implemented algorithm in CUDA to compute parallel functions over succinct trees (2 bits per vertex)

**MS in CS (Information Retrieval) | RMIT, Melbourne, AU | GPA 4.0, Summa cum laude, Dean's list** **Oct 2010**

**BS in CS (Computational Mathematics) | RMIT, Melbourne, AU | GPA 4.0, Summa cum laude, Dean's list** **Oct 2009**

## PROJECTS

**Tech Lead, Smoothbrain.ai** | [github.com/smoothbrain-ai](https://github.com/smoothbrain-ai)

- Led team of 3 to develop an Anki plugin that fetches user highlights from Readwise.io, then uses the ChatGPT API to rank usefulness and generates spaced-repetition flashcards, helping users to streamline their learning

**Tech Lead, Distributed Keyphrase Ranker** | [github.com/alexbowe/keyphrase](https://github.com/alexbowe/keyphrase)

- Researched and implemented a distributed keyphrase extractor and document ranker
- Utilized NLTK for POS tagging, Context Free Grammars for chunking, TF-IDF for ranking, and Hadoop to scale

**Tech Lead, Cosmo DNA Assembler** | [github.com/cosmo-team](https://github.com/cosmo-team)

- Led team of 3 to develop cutting edge low-memory DNA assembler, used in several Bioinformatics labs worldwide
- Improved construction speed from days to hours using parallel asynchronous multi-disk external sort

## AWARDS

**Best Prize at Bio x AI Hackathon** **Apr 2024**

- Developed A\* heuristic for DNA alignment, achieving a 3x speed-up over traditional dynamic programming approach

**Knuth Reward Check** **Mar 2013**

- Received 0x\$1 for correcting a combinatorial math error in Donald Knuth's *The Art of Computer Programming Vol. 4A*

## SKILLS

**Core Competencies:** Information Retrieval, Compression, High Performance Computing, Natural Language Processing, Self-Driving Cars, Robotics, Route Planning, Bioinformatics

**Programming Languages:** Python, C++, CUDA, Java, Erlang

**Technologies:** Numpy, SciPy, Pandas, NLTK, Boost, Thrust, gRPC, Robot Operating System