Aprup Kale

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Education

- **National University of Singapore** — Singapore
  *Bachelor of Computing - Computer Science; GPA: **4.69*** — *2022 - 2026*
  Relevant Coursework: *Linear Algebra, Software Engineering, Database Systems, Introduction to AI and Machine Learning, Design and Analysis of Algorithms, Computing for Quantitative Finance, Advanced Mathematics in Quantitative Finance, Optimisation Algorithms, Theory of Computation, Algorithm Mechanism Design, Parallel Computing, Parallel and Distributed Algorithms, Natural Language Processing, Quantum Computing*

Experience

- **National University of Singapore** — Singapore
  Research Intern — *May 2025 - Aug 2025*
  - Engaged in research on asymptotic fair division, focusing on fairness and efficiency guarantees.
  - Achieved novel theoretical results extending prior literature on fair and efficient allocations. Co-authored a paper (currently in preprint).
- **AIA Singapore** — Singapore
  Data Science Intern — *May 2024 - Aug 2024*
  - Implemented data integrity checks with the GreatExpectations library, ensuring data quality for business-critical data columns with periodic automated validations.
  - Authored comprehensive internal documentation for MLOps workflows, detailing guidelines for business and data understanding, model evaluation, model deployment, model monitoring and maintenance, and model tracking, in line with FEAT principles.
  - Developed a pipeline for some stages from model training to deployment, incorporating fairness and compliance checks also aligned with FEAT principles, and automated artifact logging (model, data, and other relevant metrics) utilising MLFlow.
- **National University of Singapore** — Singapore
  Teaching Assitant — *Aug 2023 - Present*
  - Design and Analysis of Algorithms (CS3230) in AY 2024/25 and AY 2025/26. Taught groups of approximately 20 students and graded assignments. Peak Teacher Rating: 4.7 (on a scale of 5).
  - Introduction to AI and Machine Learning (CS2109S) in AY 2024/25 and AY 2025/26. Instructed groups of approximately 15 students and graded assignments. Peak Teacher Rating: 4.6 (on a scale of 5).
  - Other courses: Data Structures and Algorithms (CS2040S), Programming Methodology I (CS1101S) and II (CS2030S).

Projects

- **Multimodal Histopathology Classification with Fine-Tuned Vision-Language Models**: Designed and implemented a CLIP-based multimodal pipeline for **multi-label histopathology diagnosis**, selectively fine-tuning image and text encoders and training a fused MLP head on ≈ 44K image-report pairs from Quilt-1M. Conducted rigorous baseline comparisons, achieving **0.99+ micro-AUC** and ≈ **68% top-3 label accuracy**, demonstrating gains from principled multimodal fusion.
- **Efficient Extractive Question Answering via Heterogeneous Transformer Ensembles**: Built and evaluated an **ensemble QA system** combining diverse base-sized transformer, systematically analysing architectural complementarity, calibration, and aggregation strategies. Showed that optimized soft-voting ensembles match large-model performance on SQuAD 1.1 (≈ **94.4 F1**) at significantly lower deployment cost, highlighting strengths in our experimental design.
- **java-slang**: Devised a web-based platform for Java programming, designed to help students learn Java easily through coding, testing, and visualizing programs directly in a web browser. Presented work at leading universities in Sweden as well as Oracle to explore global educational impact. Created tools allowing students to write and test Java code directly in web browsers without needing to install additional software. Constructed a compiler, a web-based JVM, a type-checker and a visualizer for Java.
- **Multi-Asset Multi-Strategy Portfolio Optimiser**: Designed a hierarchical portfolio optimization framework that allocates capital across assets and nested strategies using volatility-normalized position sizing.

Publications

- **Preprint Paper**: Fairly Dividing Non-identical Random Items: Just Sample or Match

Honors and Awards

- Dean's List of School of Computing, NUS - AY2025/26 Semester 1
- REx Grant for Undergraduate Research Opportunities Programme - 2024

Skills

- **Languages**: Python, Java, C++, JavaScript, TypeScript, SQL, LaTeX, MATLAB
- **Frameworks**: NumPy, Pandas, Seaborn, Matplotlib, scikit-learn, PyTorch, TensorFlow, Hadoop, Spark, Scala
- **Tools**: GIT, PostgreSQL, MySQL, SQLite, Kubernetes, Docker

Extra Curricular Activities

- **Quantitative Finance Department, NUS Investment Society** — Singapore
  Deputy Director and Quantitative Researcher — *Aug 2023 - Jul 2025*