AJEY PAI KARKALA

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EDUCATION

The University of Amsterdam *September 2021 - Present*
Amsterdam, the Netherlands
PhD Candidate
ICAI - AI for Oncology Lab
Researching risk of recurrence in breast and ovarian cancers by applying deep representation learning on histopathology images.

Indian Institute of Technology Delhi *July 2019 - August 2021*
New Delhi, India
Master of Science through Research GPA: 9.0/10.0
Department of Electrical Engineering
Major in deep learning for computer vision.

Nitte University, Karnataka *July 2014 - July 2018*
Udupi, India
Bachelor of Engineering GPA: 8.03/10.0
Department of Electronics and Communications Engineering
Major in signal processing, information theory, digital communication systems.

EXPERIENCE

The Netherlands Cancer Institute September 2021 - Present
PhD Candidate

- Currently, my research is on developing deep-learning models to validate clinical hypotheses in breast and ovarian cancer histopathology. I work in collaboration with pathologists to design algorithms.
- My focus is in quantifying biomarkers from histopathology images of cancer resections and modeling survival and outcome.

Diligent Global November 2025 - Present
AI Advisor (product development)

- Guiding Diligent Global's product team on AI strategy and methodology, from feasibility assessment to incorporation into customer-facing product services.

Rayreach Technologies November 2020 - March 2021
Consultant (computer vision)

- Created deep learning models to identify personal protective equipment and face masks worn by workers on factory floors.

Skanray Healthcare August 2018 - November 2018
R&D Engineer

- Designed hardware and firmware for power delivery, sensory acquisition and pneumatic actuation for a turbine-based critical care ventilator.

PRODUCTION PROJECTS

Dundi — AI assistant for Sanskrit scripture study dundi.io

Individual Project *Competencies: NLP, LLM applications, RAG, search & ranking, production deployment*

- Built a domain-specific conversational assistant for Upanishads, Bhagavad Gita, and Brahma Sutras with controlled response styles (explanation vs. debate) and consistent citation/reference formatting via system prompts and multi-turn dialog flows.
- Designed a retrieval stack over verse-keyed commentaries using PostgreSQL full-text search (tsvector, ranking) and snippet generation; integrated with an LLM API and streaming responses to keep latency low for interactive use.
- Implemented an end-to-end data pipeline from JSON manifests to the search backend (ingestion, preprocessing, validation, loading) to ensure traceable sources and stable retrieval behavior.
- Shipped and operated the full product (frontend + backend) in production, reaching several hundred active users; built to help my late father quickly retrieve correct scholarly references.

AutoComply — Ingredient compliance intelligence for cosmetics AutoComply

Startup CTO *Competencies: NLP, LLM workflows, RAG, information extraction, regulated-domain systems*

- Developed a B2B compliance platform that determines ingredient status by market (e.g., EU CosIng, India CDSCO and BIS, and US MoCRA) and generates structured, regulation-grounded outputs: allowed, restricted, or banned labels; concentration limits; and product-type rules.
- Built a RAG layer over vetted regulation sources (e.g., BIS IS 4707, CDSCO documents) with document-type and ingredient-aware retrieval in PostgreSQL; grounded model outputs in official text rather than open-web search.
- Engineered multi-stage LLM workflows for scale (batch screening → deep analysis for flagged items) with streaming inference and structured output parsing to produce reviewable compliance reports and exports.
- Deployed to production: Flask/Docker backend on Render; Next.js frontend with SSE streaming and PDF export; supported collaboration features for teams shipping compliance-critical decisions.

OPEN SOURCE SOFTWARES

itsper — Intra Tumoral Stroma Percentage Computer

Individual Project *competencies: Python, Pytorch*

- Itsper is a simple command line utility which can be used to compute the tumor-stroma ratio biomarker from tissue segmentations of histopathological tumor lesions. This biomarker is known to be an independent prognosticator in several cancer types. I developed it at the AI for Oncology lab.

Chaos — Real-time Lorenz Attractor Watch Face for Watchy (ESP32)

Individual project *competencies: C++, Embedded systems, Real-time simulation/graphics*

- Built an e-ink Watchy (ESP32) watch face that simulates and renders an evolving 3D Lorenz attractor in real time, with periodic rotation/updates; includes moon phase and location-based sunrise/sunset.
- Accepted by the Watchy (SQFMI) team and featured in the official watch face gallery. Check the repo here.

Runstate – Slurm job monitoring TUI runstate

Individual Project *Competencies: Python, TUI, Slurm, HPC, SSH*

- **Dashboard.** Real-time terminal UI for monitoring Slurm jobs—local or remote via SSH. Job list with filtering and refresh; drill into job details, GPU usage (e.g. nvidia-smi on remote nodes), and logs.

- **Target.** Deep-learning and HPC workflows. Config via `runstate init` (cluster and user); async SSH for remote clusters.
- **Users.** Fellow grad students who were tired of haphazardly monitoring training jobs.

ACADEMIC PUBLICATIONS

A quantitative comparison between human experts and AI at estimating tumor-stroma ratio
Medrxiv pre-print *Read the paper **here.***

- This preprint shows that an AI model estimates the tumor stroma ratio, an established prognostic cancer biomarker, with greater consistency than human experts in a large external cohort consisting of cases from across 35 different Dutch hospitals.

A shoe-mounted infrared sensor-based instrumentation for locomotion identification using machine learning methods
Published by Elsevier Measurement 2021 *Read the paper **here.***

- Designed a 1-D CNN for terrain classification using foot-to-ground-angle signals captured by a novel wearable instrument. A new scheme to extract features from time-series was proposed using the histogram of oriented gradients. The study will help in development of low cost intelligent lower-limb prosthetic for trans-femoral amputees.

CONFERENCES

Reliable comparisons between AI models and human experts in computational pathology
Oral presentation at the European conference on Digital Pathology (2024), Lithuania.

While concordance statistics measure AI-human agreement levels, it is hard to determine if AI outperforms human scoring due to ambiguous labels. In this work, we compare human experts and an AI model in extracting a prognostic biomarker from routine H&E-stained whole slide images (WSIs) of early stage triple-negative breast cancer resections from across 33 cancer centers in the Netherlands. We make recommendations for developing AI models that can be routinely deployed in clinics.

OTHER PROJECTS AND SKILLS

A new self-supervised method for learning anatomical shapes and H&E stains in biopsy images of different tissues using targeted super-pixel inpainting and elastic deformation.
Individual project *competencies: Python, Tensorflow, Keras*

- An encoder-decoder pair is trained to reconstruct an image deformed and masked using a novel pretext task. The model learns representations for shapes and H&E color stain distributions of different important tissues in a biopsy image. Find the code **here.**

Genomic Sequence Analysis using Support Vector Machines
Individual project *competencies: Python, numpy, sklearn*

- A python implementation to classify ncRNA strands using different Support Vector Machines and interpret their behaviour with different regularisation parameters and sigma values. Find the code **here.**

Adaptive background mixture models for real-time tracking
Team project, lead coder. *competencies: Python, numpy, opencv*

- An exact, non-vectorized re-implementation of the Stauffer-Grimson adaptive background subtraction algorithm for videos. Idea is reproduced from the original paper. Find the code **here.**

ACHIEVEMENTS

Formally inducted into the Sakura Science Club in December 2017 by the Japan Science and Technology Agency (JST).

Licensed HAM radio user in India (restricted grade).

Self-published a poetry book titled "Wild Flowers". It was unveiled to the public by Mr.Amish Tripathi in February 2019.

Co-founded **Lokagatha.** It is a portal dedicated to disseminating traditional lores, philosophy and history of the Hindu culture.

REFERENCES

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Dr Joren Brunekreef: j.brunekreef@nki.nl