

Dr. Chris Fourie

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(Software, Backend, DevOps, Data, ML Engineer)
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About Me

Medical + AI/ML/ComSci Background & Current Work

- Medical doctor turned MLOps engineer and health data scientist, trying to use the powers of AI for social good.
- I work full-time as a data / MLOps engineer for the South African Western Cape Provincial Health Data Centre, building digital infrastructure for large scale privacy preserving federated analysis of observational health data.
- Part-time I provide consulting services for digital health, artificial intelligence (AI) / machine learning (ML) and software engineering.

Technical Expertise

- My experience is primarily as an MLOps engineer for research which spans software engineering (cloud, backend, and DevOps), data engineering and data science.
- I am very familiar with container based microservices and pipelines for data (ETL), ML model training and ML model serving as well as developing tooling to enable and accelerate computational research in health and biological domains.

Education & Research

- My medical degree (MBBCh) and master's in computer science (MSc ComSci) were carried out at the University of the Witwatersrand (Wits) in Johannesburg, South Africa.
- I completed my master's research under the supervision of Prof. Benjamin Rosman as a member of the Robotics, Autonomous Intelligence and Learning (RAIL) Lab.
- My topic was at the intersection of NeuroAI and multi-agent reinforcement learning (RL), exploring biologically plausible alternatives to backpropagation, in particular how networks of RL agents (CoAgent networks) could be used as nodes/neurons in a neural network.

Community Leadership

- In 2020, I co-founded SisonkeBiotik, a grassroots participatory research community making AI/ML for health research in Africa more accessible.
- Subsequently, I co-founded Grassroots-Parti, a collective of communities with a focus on helping incubate and provide mutual support for grassroots participatory communities in Africa.
- I participate as a technical advisor on the steering committee for the Data Science Without Borders project, a 3-year initiative to develop capacity for federated health data analyses across institutions in Cameroon, Ethiopia and Senegal.
- I am a co-founder for the AfriMedQA project that has created a novel benchmark dataset and rigorous evaluation of 20+ LLMs for African healthcare data, spanning 32 clinical specialties, contributed by 1k+ African clinicians across 15 countries.

Motivation & Vision

- I am motivated by my experience growing up in South Africa, witnessing the devastating effects of perpetuated inequity.
- During my medical training, I saw first hand the challenges this has created - the severe impact that resource scarcity and the legacy of colonialism can have on the health and wellbeing of individuals and their communities.
- My long term career interests intersect at collaboratively developing industry solutions and forwarding academic efforts to address inequity, with close consideration for the diverse and complex nature of our societal systems.

Technical Skills

- **Natural languages:** English(C2), German(B2)
- **Programming languages:** Python, C, Java, TypeScript
- **MLOps & Engineering:** End-to-end model and data benchmarking and serving pipelines
- **Cloud (AWS, Azure):** Terraform, Boto3, Chalice, Batch, SQS, SageMaker, Lambda
- **DevOps:** Jenkins, Airflow, Azure DevOps, Linux, Docker, Git
- **Backend:** SQL (Postgres, SQL Server), noSQL (DynamoDB)
- **Data Engineering:** Databricks, PySpark, Pandas

- **Digital health:**
 - Health data accessibility and security: Secure Data Environments / Trusted Research Environments, health data governance
 - Interoperability: FHIR and OpenEHR APIs
 - Federated analyses and privacy preserving methods: OMOP common data model, de-identified and synthetic data, differential privacy, homomorphic encryption, secure multiparty compute, federated learning
- **Data Science / ML:**
 - Neural Networks: PyTorch, TensorFlow
 - Scientific Computing: SciKit learn, NumPy
 - Experimentation: MLFlow, Weights & Biases
 - Data Visualization: Seaborn, Matplotlib
 - Computer Vision: OpenCV
 - Reinforcement Learning: OpenAI Gym, Stable Baselines
- **Leadership & Consulting:** Building and leading teams, Technical consulting, Academic paper writing

Industry Experience

Data / MLOps Engineer and Health Data Scientist **2023 – Present**

Western Cape Provincial Health Data Center (ZA)

- Co-principal investigator for federated analysis with Brazilian National research group CIDACS on TB and syphilis in pregnancy
- Project lead to establish secure data environments / trusted research environments for research data accessibility
- Project lead for CI/CD pipeline development and Python dependency management in Databricks
- Development and maintenance of data pipelines for data ingestion and processing from both provincial public health facilities and national public health data repositories

MLOps Engineer and Health Data Scientist **2020 – 2023**

LifeQ (USA)

- Working on projects related to analysis of health / biometric data from continuous and remote monitoring devices
- Development of machine learning (ML) and data pipelines, backend, DevOps and cloud infrastructure for AI / machine learning

Technical Consultant **2020 – Present**

- Data Science Without Borders (Africa) - Technical advisor on steering committee
- FruitPunch AI (Netherlands) - Developing experimentation and data pipelines for LLM based inference on genomics data
- MotherDAO Labs (Canada) - Developing AI strategy and conducting feasibility analyses
- RetroRabbit (ZA) - Conducting technical interviews
- MambaInsights (UK) - MLOps software solution implementation
- Cebisa Health (ZA) - Strategy consulting for electronic health record platform

MLOps Engineer Internship **2020**

DataProphet (ZA)

- Projects on ETL and cloud orchestration for ingestion of factory sensor data to ML and data pipelines

Education and Academic Experience

Masters in Computer Science (Focus on AI/ML) **2019 – 2022**

University of the Witwatersrand (ZA)

- Courses: Machine learning, robotics, high performance computing, algorithm analysis, computer vision and reinforcement learning
- Research: Impact of Noise on Learned Value Functions at Depth in CoAgent Networks for Neural Network Credit Assignment
- Projects available at: chrisfourie.africa/comsci-msc-projects

BSc Engineering **2017 – 2018**

University of Salzburg & Technical University of Munich

- First semester completed (in German) of Joint Degree Bachelorstudium Ingenieurwissenschaften

Medical Degree (MBBCh) **2009 – 2015**

University of the Witwatersrand (ZA)

Selected Publications

- **AfriMed-QA: A Pan-African, Multi-Specialty, Medical Question-Answering Benchmark Dataset** (AAAI, 2024) [link to paper]
- **AfriBiobank: Empowering Africa's Medical Imaging Research and Practice Through Data Sharing and Governance** (MICCAI, 2024) [link to paper]
- **A Framework for Grassroots Research Collaboration in Machine Learning and Global Health** (ICLR, 2023) [link to paper]
- **Essentials of Global Health Text Book** (Elsevier, 2018) - Co-Author of chapter on Trauma and Injury. British Medical Journal Book Awards, 1st place in Public Health division. [link to book]

Communities and Academic Affiliations

- Co-founder of AfriMedQA project - Created novel benchmark dataset and rigorous evaluation of 20+ LLMs for African healthcare data, spanning 32 clinical specialties, contributed by 1k+ African clinicians across 15 countries
- African Grassroots Participatory Community Collective (Co-founder, 2023 – Present)
- SisonkeBiotik community for data science / AI / ML research for healthcare in Africa (Co-founder, 2020 – Present)
- RAIL Lab, robotics and autonomous intelligence and learning lab at University of Witwatersrand (member, 2019 – 2023)
- Deep Learning Indaba community building African AI/ML and data science capacity (community organiser, 2023 – 2024)
- Deep Learning IndabaX South Africa community building African AI/ML capacity (community organiser, 2021 – 2022)
- African Institute for Mathematical Sciences (AIMS) African Machine Learning Masters (AMMI) Rwanda, Reinforcement Learning Course (tutor, 2020)
- Computational Neuroscience Imbizo, summer school for AI and neuroscience (alumni, 2019)
- South African Medical Students Association (Director) / International Federation of Medical Student Associations (IFMSA) President South Africa (2014 – 2015)

Conferences and Talks

- Invited speaker AI for health @ Africa Health Exhibition - "3IR b4 4IR: Data Accessibility to Enable African Data Science, ML and AI for Health" [slides] (2023)
- Invited speaker AI for health @ ICLR / IndabaX - "AI 4 Health in Production" [slides] (2023)
- Deep Learning Indaba (organizing committee, 2023)
- DS4Health Workshop @ Deep Learning Indaba (lead organiser, 2023)
- Deep Learning IndabaX South Africa (organizing committee, 2023)
- Invited speaker AI for health @ IndabaX Zimbabwe (2023)
- AML Health Workshop @ Deep Learning Indaba (lead organiser, 2022)
- Deep Learning IndabaX South Africa (organizing committee, 2021-2022)
- Deep Learning Indaba, Kenyatta University, Nairobi Kenya (presented poster on pan-African ML for health collaboration, 2019)
- IBRO-Simons Computational Neuroscience Imbizo / Summer School (participant fully funded, 2019)

Extra-Curricular Activities

- **Outdoors:** Walks in the mountains, rock climbing, cycling and snowboarding whenever possible
- **Indoors:** Board games, reading speculative fiction, especially hard and utopian sci-fi, Ursula Le Guin, Greg Egan, Peter Hamilton, Octavia Butler and Dennis Taylor
- **Educational:** Recreational language learning, Cooking, sometimes baking, Casual sketching and water colours

References

Prof. Andrew Boule

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Public Health Specialist
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[Citations]

George Cooper

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Prof. Benjamin Rosman

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[Citations]