Kale-ab Tessera

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About me

Kale-ab is a PhD candidate in the Autonomous Agents Research Group at the University of Edinburgh, supervised by Dr. Stefano Albrecht. His work aims to make Multi-Agent Reinforcement Learning (MARL) algorithms more robust and reliable for real-world collaboration. Before his PhD, he gained 4.5 years of experience in machine learning, including 2.5 years as a research engineer at InstaDeep, and 3 years of experience in software engineering. Kale-ab is also committed to supporting impactful technology projects in Africa and promoting diversity within the machine learning community.

Education

Doctor of Philosophy - PhD, Focusing on Multi-Agent Reinforcement Learning   Edinburgh, UK
University of Edinburgh   September, 2023 –Present

MSc in Computer Science, Focusing on Deep Learning, *Distinction*   Johannesburg, South Africa
University of Witwatersrand   2018–March, 2021

- Dissertation (*83%*): "On Sparsity in Deep Learning: The benefits and pitfalls of Sparse Neural Networks and how to learn their architectures" - link, Supervisor: Prof. Benjamin Rosman, Collaborators: Sara Hooker.
- Selected Coursework (*85%*): Machine Learning, Reinforcement Learning, HPC and Robotics.
- Key achievements: Postgraduate Merit Award, Microsoft Prize, presented research at the "Sparsity in Neural Networks" workshop.

Honours in Computer Science, *Distinction*   Pretoria, South Africa
University of Pretoria   2016

BSc. in Computer Science   Pretoria, South Africa
University of Pretoria   2013–2015

Experience

Research Engineer   Johannesburg, South Africa
InstaDeep   March 2021 – September 2023

Worked as a Research Engineer in the MARL team, focusing on advanced research and applications to complex, real-world challenges.

Achievements:

- Managed a team of three research engineers and an intern, applying MARL to diverse real-world domains.
- Managed a team of four research engineers working on MARL research.
- Co-authored Mava, a scalable MARL framework, repo, paper and blog.

Machine Learning Engineer   Johannesburg, South Africa
Multichoice   Apr 2019 - Feb 2021

Worked on using machine learning to model and predict the behaviour of over 15 million customers.

Intermediate Software Engineer Johannesburg, South Africa

Entelect Nov 2017 - March 2019

Built highly scalable, fast, responsive websites for major clients.

Software Engineer Pretoria, South Africa

RetroRabbit Jan 2016 - Oct 2017

Built robust backend APIs with multiple system integrations.

PUBLICATIONS

[1] K.-a. A. Tessera, A. Rahman, and S. V. Albrecht, "Hypermarl: Adaptive hypernetworks for multi-agent rl", *arXiv preprint arXiv:2412.04233*, Dec. 2024-12-05, Paper.

[2] A. Kapoor, S. Swamy, K.-a. Tessera, M. Baranwal, M. Sun, H. Khadilkar, and S. V. Albrecht, "Agent-temporal credit assignment for optimal policy preservation in sparse multi-agent reinforcement learning", in *Coordination and Cooperation for Multi-Agent Reinforcement Learning Methods Workshop at RLC 2024*, Paper, 2024.

[3] O. Mahjoub, R. de Kock, S. Singh, W. Khlifi, A. Vall, K.-a. Tessera, and A. Pretorius, "Efficiently quantifying individual agent importance in cooperative marl", *(Oral) eXplainable AI approaches for deep reinforcement learning (XAI4DRL) Workshop @ AAAI*, 2024, Paper.

[4] S. Singh, O. Mahjoub, R. de Kock, W. Khlifi, A. Vall, K.-a. Tessera, and A. Pretorius, "How much can change in a year? revisiting evaluation in multi-agent reinforcement learning", *eXplainable AI approaches for deep reinforcement learning (XAI4DRL) Workshop @ AAAI*, 2024, Paper.

[5] J. C. Formanek, C. R. Tilbury, J. P. Shock, K.-a. Tessera, and A. Pretorius, "Reduce, reuse, recycle: Selective reincarnation in multi-agent reinforcement learning", in *(Oral) Workshop on Reincarnating Reinforcement Learning at ICLR 2023*, Paper, Website, Mar. 2023.

[6] A. Smit, P. Duckworth, N. Grinsztajn, K.-a. Tessera, T. Barrett, and A. Pretorius, "Are we going MAD? benchmarking multi-agent debate between language models for medical q&a", in *Deep Generative Models for Health Workshop NeurIPS 2023*, Paper, Oct. 2023.

[7] K.-a. Tessera, C. Tilbury, S. Abramowitz, R. de Kock, O. Mahjoub, B. Rosman, S. Hooker, and A. Pretorius, "Generalisable agents for neural network optimisation", in *Workshop on Advancing Neural Network Training: Computational Efficiency, Scalability, and Resource Optimization (WANT@NeurIPS 2023) and OPT 2023: Optimization for Machine Learning*, Paper, Poster, Oct. 2023.

[8] K.-a. Tessera, C. Matowe, A. Pretorius, B. Rosman, and S. Hooker, "Just-in-time sparsity: Learning dynamic sparsity schedules", in *Dynamic Neural Networks, ICML Workshop*, Paper, Poster, Slides, 2022.

[9] A. Pretorius, K.-a. Tessera, A. P. Smit, C. Formanek, S. J. Grimbly, K. Eloff, S. Danisa, L. Francis, J. Shock, H. Kamper, *et al.*, "Mava: A research framework for distributed multi-agent reinforcement learning", *arXiv preprint arXiv:2107.01460v1*, 2021, Paper, Framework, Blog.

[10] K.-a. Tessera, S. Hooker, and B. Rosman, "Keep the gradients flowing: Using gradient flow to study sparse network optimization", in *Sparsity in Neural Networks Workshop*, Paper, Poster, Slides, 2021.

[11] I. S. Yusuf, K.-a. Tessera, T. Tumiel, S. Nevo, and A. Pretorius, "On pseudo-absence generation and machine learning for locust breeding ground prediction in africa", in *AI + HADR and ML4D NeurIPS Workshops*, Paper, Blog, Code, 2021.

SCHOLARSHIPS AND AWARDS

- **CIFAR Inclusive AI Scholarship**, CIFAR 2024

Scholarship to attend the CIFAR Deep Learning + Reinforcement Learning (DLRL) summer school in Toronto, Canada.

- **Informatics Global PhD Scholarship**, University of Edinburgh   2023–2027
  Full PhD scholarship awarded for academic excellence.
- **Postgraduate Merit Award**, University of Witwatersrand   2019, 2020
  Full tuition scholarship for top postgraduate students with averages above 75%.
- **Microsoft Prize - Best Poster**, Deep Learning Indaba   2019
  Awarded for having the best research poster among 194 submissions, the prize included a sponsored trip to NeurIPS 2019.
- **Academic Honors and Merit Awards**, University of Pretoria   2015, 2016
  Includes Academic Honorary Colours for distinction (average of 80.75%) (2016) and Amazon Prize for Best Mobile Application (2015).
- **Matric (Final Year High-School) Academics**, PEPPS College   2012
  Top 1% of IEB IT Matric Students in South Africa and received 7 distinctions with an average of 87%.

RESEARCH PRESENTATIONS

- Presented practical sessions at Deep Learning Indaba: "Introduction to ML using JAX" (2022, 2024) and "Introduction to Reinforcement Learning".   2022, 2024
- Presented "Introduction to Deep Reinforcement Learning" at the University of Pretoria (UP), Indaba X Ghana, and Deep Learning Indaba. UP slides, Indaba X slides.   2022–2023
- Spotlight talk at Deep Learning Indaba - 2022 (video, slides, poster), 2019 (video, slides, poster).   2019, 2022
- Talk at Indaba X South Africa: "Playing Starcraft and Saving the World Using Multi-agent Reinforcement Learning" - video, slides, notebook.   2021
- Presented at Deep Learning: Classics and Trends (DLCT) - slides, website.   2021
- Talk at Google Brain Sparsity Reading Group - slides.   2021
- Spotlight talk at Deep Learning Indaba 2019 - video, slides, poster.   2019

OPEN SOURCE

- Deep Learning Indaba Practicals (2022, 2023, 2024) - A collection of high-quality practicals covering a variety of modern machine learning techniques using Jax + Flax.
- Mava v1 (GitHub) - A scalable MARL framework using Tensorflow, Deepmind's Acme and Reverb.
- Pseudo Absence Generation and Locust Prediction (GitHub) - Developed ML-based locust breeding ground prediction with pseudo-absence generation.
- Baobab (GitHub) - Multi-tenant application for managing large-scale ML and AI events.

See a full list of open source projects on GitHub.

VOLUNTEERING, ORGANIZING AND REVIEWING

- Co-host of an RL Reading Group Reading group, YouTube   2024 - Present
- Conference Paper Reviewer   2023 - Present
  NeurIPS (2023, 2024), ICLR (2025), AAMAS (2023), Black in AI (2017, 2018)
- Deep Learning Indaba   2020 - 2024
  Chair of the Practicals Committee (2022, 2023), helped develop hands-on ML and RL practicals (2022, 2023, 2024), Programme Committee member (2022, 2023), Steering Committee member (2022), Application and Selection Committee (2020).

- Africa to Silicon Valley Educator   2022
  Taught an "Introduction to Machine Learning" Course to talented African students at Africa to Silicon Valley.
- One of the organizers of the ML Efficiency Workshop at the Deep Learning Indaba   2022