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Stephen Kiilu

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Passionate machine learning researcher with expertise in AI/ML and a strong focus on advancing natural language processing (NLP). Former Research Fellow at the University of Tübingen, working under the Cluster of Excellence in Machine Learning. Currently researching temporal reasoning in large language models (LLMs) for context-intensive question-answering tasks. Key interests include reasoning in LLMs, multilingual, and low-resource NLP.

Education

- **African Institute for Mathematical Sciences (AIMS) Senegal** | MSc in Machine Intelligence. **2022 – Present**
- **African Institute for Mathematical Sciences (AIMS) Rwanda** | MSc in Mathematical Sciences. **2020 – 2021**
  Grade: A Very Good Pass (84%).
- **Maseno University, Kenya** | BSc in Applied Statistics with IT. **2014 – 2018**
  Grade: First Class Honours (72%).

Research Experience

Research Fellow at University of Tübingen, Germany | Temporal Reasoning in LLMs **April 2024 – Present**
Supervisor: Professor Dr. Carsten Eickhoff

- Evaluated large language models (LLMs), such as GPT-3.5, for time-sensitive question-answering and reasoning tasks. Utilized in-context learning methods, including zero-shot, few-shot learning, and chain-of-thought (CoT) approaches, to assess model performance.
- Integrated temporal information extraction tools like CAEVO and SUTime to develop a temporal reasoning LLM based on the LLaMA 8B model. Applied LoRA for supervised fine-tuning to enhance model performance, improving efficiency and adaptability in temporal reasoning tasks.
- **Impact/Outcome:** Showed that LLMs like GPT-3.5 demonstrate temporal reasoning capabilities, but their performance remains significantly below human level in time-sensitive reasoning tasks. Additionally, fine-tuning the LLaMA 8B model with LoRA significantly improved temporal reasoning performance, resulting in a substantial reduction in question-answering errors and 2X overall performance in terms of Exact Match (EM) and F1 scores.

Master's Thesis at AIMS Senegal | NLP for Low-Resources Languages **2022 - 2023**
Supervisor: Machel Reid, Research Scientist at Google DeepMind.

- Developed **pivot-prefinetuning**, a novel fine-tuning approach for large models, where a pivot language pair is used in a pre-fine-tuning procedure to improve data efficiency in machine translation for low-resource languages.
- **Impact/Outcome:** Showed that pivot-prefinetuning significantly improved performance in both automatic and human evaluations, enhancing machine translation quality for low-resource languages.
- Published a paper, *Tiny "Pivot Pre-finetuning for Low Resource MT: A Case Study in Kikamba"*, accepted at ICLR 2023.

Teaching Experience

African Brain Data Science (ABDS) Academy 2024 | Teaching Assistant and Mentor **December 2024**

- Contributed to a two-week intensive training program designed to equip African students with state-of-the-art research techniques in brain data science.
- Provided academic support during lectures and tutorials, guiding students through their projects.
- Delivered a mentorship talk on pursuing careers in machine learning and neuroscience, inspiring students to navigate their academic and professional paths.

Publications

1. "Fitting Zambia's Currency Market Returns with the Poisson Compound Model with Normal Inverse Gaussian Jumps." *Emmanuel Malichi, **Stephen Kiilu**, et al. (2024). International Journal of Advances in Applied Mathematics and Mechanics.*
2. "Pivot Pre-finetuning for Low Resource MT: A Case Study in Kikamba." ***Stephen Kiilu**, Machel Reid. ICLR 2023 Tiny Papers track.*

Work Experience

NLP Researcher at the Chichewa NLP Project, Online **Oct 2023 – March 2024**
- Collected, curated, and documented datasets for various NLP tasks in Chichewa.
- Fine-tuned and evaluated large language models (LLMs) for machine translation (MT) tasks using PyTorch and Hugging Face transformers.

Environment and Sustainability Advisor at Crossroads International, Ghana **Sept 2022 – April 2023**
- Advocated for Crossroads International's gender equality and women empowerment programs in Ghana.
- Developed policies aligned with the 2021-2025 climate action agenda of the iSpace Foundation.
- Conducted training and workshops to build capacity for climate change in communities in Ghana.
- Led the iSpace Foundation's climate change research and outreach activities.

- **Achievements:** Awarded a 1,000 Canadian Dollar grant from Crossroads International for my project proposal, "Climate Champions," focused on delivering climate change education to primary and high schools across Accra, Ghana.

Short Projects

Implementing the Hodgkin Huxley Model | IBRO-Simons Computational Neuroscience Imbizo, Cape Town, South Africa. **Jan 2024**
- Implemented neuronal action potentials based on the Hodgkin-Huxley equations in Python using the Brain 2 simulator.

Decoding Hand Shapes from fMRI Data Using Different Machine Learning Models | IBRO-Simons Computational Neuroscience Imbizo, Cape Town, South Africa. **Jan 2024**
- Built machine learning classification models, including support vector machine, random forest, k-nearest neighbor, and logistic regression, to decode hand shapes (rock, paper, and scissors) from fMRI data.

Decoding the Brain: Statistical Analysis of the Volume of the Human Hippocampus | African Brain Data Science (ABDS), Lagos, Nigeria. **Dec 2023**
- Combined neuroimaging tools like Brainlife and statistical tests (e.g., t-test) to investigate gender differences in hippocampal volume between females and males. and males

Working memory RNN | TReND Computational Neuroscience and Machine Learning School, Accra, Ghana. **June 2023**
- Trained a recurrent neural network (RNN) in PyTorch to explore connectivity patterns in RNNs for solving tasks and storing input information.

Paddy Disease Classification | African Institute for Mathematical Sciences (AIMS) Senegal. **August 2022**
- Used deep learning computer vision methods to classify images of paddy leaves, achieving an accuracy of 98%.

Neural Machine Translation (NMT) Hackathon (1^{st} position**)** | (AIMS) Senegal. **June 2022**
- Developed a speech-to-speech neural machine translation system for communication between Wolof-speaking Senegalese natives and English-speaking visitors, winning the hackathon with an accuracy of 83%.

Workshops & Summer schools

IMPRS-IS Boot Camp 2024 | AllgaüStern Hotel, Germany. **Sept 2024**
Deep Learning Indaba 2024 | Dakar, Senegal. **Sept 2024**
IBRO-Simons Computational Neuroscience Imbizo | Cape Town, South Africa. **Jan 2024**
African Brain Data Science (ABDS) Academy | Lagos, Nigeria. **Nov – Dec 2023**
TReND Computational Neuroscience and Machine Learning Summer School | Accra, Ghana. **June 2023**
International Conference on Learning Representations (ICLR) 2023 conference | Kigali, Rwanda (Paper accepted to ICLR 2023 Tiny Papers track). **May 2023**
CIMPA School on Mathematics of Climate Science | AIMS Rwanda, Kigali. **March 2023**

Honours and Awards

Deep Learning Indaba Conference 2024 travel grant | Dakar, Senegal. **July 2024**

Cluster of Excellence – Machine Learning for Science Scholarship | University of Tübingen, Germany. **Nov 2023**
IBRO-Simons Computational Neuroscience Imbizo | Cape Town, South Africa. (Awarded scholarship valued at $6000). **Aug 2023**
African Brain Data Science (ABDS) | Lagos, Nigeria. **Aug 2023**
Google Conference Scholarship to attend the ICLR 2023 conference | Kigali, Rwanda. (Awarded $1300). **April 2023**
ICLR 2023 travel grant award to attend the ICLR conference | Kigali, Rwanda. **April 2023**
TReND Computational Neuroscience and Machine Learning Scholarship | Accra, Ghana. **March 2023**
Google and Meta Scholarship | AMMI-AIMS Senegal. (Full scholarship for African Masters in Machine Intelligence). **Jan 2022**
Mastercard Foundation Scholarship | AIMS Rwanda. (Full scholarship for Masters in Mathematical Sciences). **Aug 2020**

Volunteer Activities

Deep Learning Curriculum Content Reviewer | Neuromatch Academy (NMA). **April – Sept 2023**
Trainer | Teacher Training Program (TTP). **June 2021**

Presentations and Talks

1. **Deep Learning Indaba 2024** |Poster Presentation (won best poster award) | Dakar, Senegal. **Sept 2024**
2. **6th Annual Conference "Machine Learning in Science"** | Poster Presentation | University of Tübingen, Germany. **July 2024**
3. **International Conference International Conference (ICLR 2023)** | Poster Presentation | Kigali, Rwanda. **May 2023**.

Featured Blogs

Shaping futures in neuroscience – A case study from TReND-CaMinA | Sainsbury Wellcome Centre, UCL. **Nov 2024**

Key Skills

Programming	Python and R.
Frameworks	PyTorch, HF Transformers, JAX, Scikit-Learn.
Software	STATA, SPSS, SQL, Tableau.
Tools	Bash/Zsh, Linux, LaTeX, BrainLife (neuroimaging).
Communication	Technical writing, data visualization, scientific communication.
Languages	Swahili (native), English (fluent), German (basic).