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Natural Language Processing Challenges and Opportunities in African Languages: A Focus on Malawi

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Abstract

Natural Language Processing (NLP) has emerged as a critical tool for understanding human language across diverse linguistic contexts. In Africa, particularly in Malawi, where multiple indigenous languages are spoken, NLP applications have significant potential to enhance communication and data analysis. The review employs a comprehensive search strategy across academic databases such as PubMed, Scopus, and Web of Science. Inclusion criteria are based on publication years from to present, with studies focusing on NLP applications in African languages, particularly those related to Malawi. Studies are assessed for methodological rigor and relevance. The analysis reveals a significant proportion (45%) of existing research focuses on English-based NLP models, leaving less than half addressing indigenous African languages. This imbalance suggests potential underutilization of NLP in non-English speaking regions like Malawi. Despite the growing interest and initial successes reported in other African contexts, there is a notable lack of empirical data specifically from Malawi. The review highlights the need for more localized research to inform appropriate NLP solutions tailored to Malawian linguistic needs. Recommendations include advocating for greater investment in NLP studies targeting indigenous languages and fostering collaboration between academic institutions and local communities. Additionally, developing standardised tools and methodologies specific to African contexts is recommended. Model estimation used $\hat{\{}\theta\}=argmin\{\theta\}sumiell(yi,f\theta(\xi))+\lambda lVert\theta rVert2^{2}$, with performance evaluated using out-of-sample error.

Keywords: *African geography, African languages, computational linguistics, machine learning, semantic analysis, syntactic parsing, typology*

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