

**Detecting Ambiguities in Requirement Documents Written in Arabic Using
Machine Learning Algorithms**

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Abstract

The identification of ambiguities in Arabic requirement documents plays a crucial role in Requirements Engineering. This is because the quality of requirements directly impacts the overall success of software development projects. Traditionally, engineers have used manual methods to evaluate requirement quality, leading to a time-consuming and subjective process that is prone to errors. In this thesis, we introduce a novel approach to detecting ambiguities in requirements documents that will make a major contribution to the field of requirements engineering for Arabic-language projects. In addition to applying existing machine-learning algorithms to the Arabic text, we develop a specialized framework that integrates linguistic analysis, domain-specific knowledge, and advanced machine-learning techniques. Also thesis aims to compare various machine learning algorithms according to their abilities in classifying requirements written in

Arabic as decision tree, support vector machine (SVM), k-nearest neighbors (KNN), logistic regression (LR), random forest (RF), XGBoost, and the AraBERT model. The performance of these algorithms is evaluated based on their accuracy (F1, recall, precision) also two different stemmers were used to compare full terms and stemmed terms. The findings reveal that Random Forest outperformed all stemmers, achieving an accuracy of 0.95 without employing a stemmer, 0.99 with the ISRI Stemmer, and 0.97 with the Arabic Light Stemmer. These results highlight the robustness and practicality of the Random Forest algorithm. The K-Nearest Neighbors (KNN) algorithm also demonstrated strong performance, achieving an accuracy of 0.96 without a stemmer, 0.97 with the ISRI Stemmer, and 0.97 with the Arabic Light Stemmer. And the AraBERT result in all random states was the average accuracy is 0.978, while the average recall is 0.98 and the average F1 score is 0.978. This research aims to overcome the limitations of manual assessment by leveraging machine learning algorithms and deep learning model to automate the evaluation of requirements quality. The objective is to enhance the efficiency and objectivity of the assessment process.

Keywords: Software Engineering, Arabic requirements Ambiguous requirement classification, unambiguous requirements, Machine learning AraBERT

