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Enhancing Visualization in Readability Reports for Arabic Texts

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Abstract

Readability assessment for Arabic is still largely underserved in both research and software development. We believe that improved usability of the few tools currently released will motivate a greater user-base, and in doing so garner more interest in this topic from the research community. With that in mind, we examine recently developed readability tools with a graphical component, formulate recommendations, and propose visual enhancements to the way readability scores are reported to improve usability and informativeness.

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Keywords: readability; reading difficulty; Arabic; Modern Stanadrd Arabic; MSA; usability; visualization; graphical user interface; GUI;

1. Introduction

The term ‘readability’ is generally used to indicate the level of difficulty in reading and understanding a text by a reader. The earliest works date back nearly a century ago, when educators manually developed mathematical formulas to quantify the readability of texts. Readability was either measured in terms of discreet grade levels (1, 2, 5 etc.), difficulty levels (easy, intermediate, difficult) or score ranges on a scale [1]. That method remained largely unchanged until computational approaches for natural language processing and machine learning came into play. Since then, the focus gradually shifted from “quantifying” reading difficulty to “automating” both the development and application of readability measures to texts [2]. Compared to work done on English [1] and some other

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languages [2], efforts for Modern Standard Arabic (MSA) have been underwhelming until recent years when researchers, armed with better NLP tools for MSA, began tackling readability for Arabic and its potential applications such as text simplification [3] or machine translation [4].

Budding research in readability assessment for Arabic would evolve better with feedback from real users. It is crucial to implement readability metrics and models as ready-to-use software tools instead of leaving them confined to research circles and academic publications. Another issue is that most applications using a readability assessment component simply integrate it as a module supporting the primary task of the application. That task could be matching learners to texts from a database, learner assessment, or text simplification, to name a few. In most cases, an in-depth examination of a given text's readability is not the main purpose, so the readability module tends to be black-boxed and produces minimal reporting on assessment results.

The work we present is a study in the enhancement of an existing readability assessment tool using alternative visualization methods to improve the understandability and depth of information provided to the user.

2. Readability assessment tools

There is a substantial body of work on readability measures for English, with other languages following suite [1, 2, 5], and recent applications integrating readability tools within specialized information retrieval systems [6], simplification tools [3], and so on. The use of well-known formula-based methods was the dominant trend for their ease of implementation and interpretation. Other tools using readability assessment based on machine-learning (ML) methods usually integrate a classifier developed in-house by the same research team or close collaborators [3, 6].

2.1. Tools for Arabic readability

Work for Arabic is still focused on developing reliable metrics for readability assessment, as formulas [7, 8] or as ML models [9, 10]. The ML approach is gaining attention as better quality training data and more precise feature extraction tools become available. We refer you to [10] for a brief overview of recent research in Arabic readability.

For the purpose of evaluating and enhancing visualization in readability reports, we examine recent works satisfying either or both of the following criteria: (1) a formulaic readability model that can be replicated; (2) a graphical user interface for editing Arabic text and measuring its readability.

Arability. In developing the "Arability" tool, Al-Khalifa and Al-Ajlan [9] trained a Support-Vector Machine classifier on a combination of shallow lexical features and bi-gram language model data extracted from the Saudi Arabian Arabic language textbook curriculum. The resulting model was then deployed in a graphical interface that simply enumerates a subset of the text features (average words per sentence, characters per word, characters per syllable, and average word frequency) and displays the predicted level as shown in ([9] fig. 5 and 6). However, because Arability uses an opaque ML-based classifier, users would have difficulty adapting a text to a specific target level if they have no knowledge of the full range of features involved nor how changes in these features affect the readability level.

OSMAN. This formulaic metric by El-Haj and Rayson [8] is an adaptation of a formula originally developed for English. It is recalibrated for Arabic using the English and Arabic data from the United Nations corpus of public domain documents. OSMAN incorporates a number of additional parameters to account for the morphological complexity of Arabic, namely, diacritics and words perceived as long or complex. OSMAN comes with comes with an open-source implementation, but not a graphical interface that suits our purposes. See [8] for a more detailed breakdown of the formula.

AARI. Al-Tamimi et al. [7] performed a study on the Jordanian school curriculum using an optimized subset of text features by applying factor analysis to a list of features inspired by well-known readability formulas, thus minimizing overlap and the presence of correlated factors in the formula. The result was the AARI score (Automatic Arabic Readability Index) which maps directly to curriculum grade levels from 1st to 10th grade or above. The AARI satisfies both criteria, being a formulaic readability measure with a graphical interface for entering text and calculating its AARI score.