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A Distributional Semantics Model for Image Recommendation using Learning Analytics

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Abstract: In Society 5.0, a global trend is to process educational big data in order to solve various social and educational problems. This study, leveraging the power of learning analytics intends to investigate an unsolved problem in the domain of image-based vocabulary learning, namely how to recommend context-specific appropriate images at the right time, right place and right context. The aim of this study is to develop an innovative image recommendation system that can recommend Feature-based Context-specific Appropriate Images (FCAI) by analyzing learners' previous learning records. This paper introduces a distributional semantics model for image recommendation.

Keywords: Distributional semantics model, image recommendation, image analytics, informal language learning, learning analytics, ubiquitous learning logs, vocabulary learning.

1. Introduction

Nowadays, informal vocabulary learning applications such as duolingo, Rosetta stones, VoLT, Rakuten's lingvist etc. on both web and mobile platforms are gaining much popularity among motivated foreign language learners. To support informal vocabulary learning, our initiative is SCROLL (System for Capturing and Reminding of Learning Logs), a context-aware ubiquitous language learning system that allows users to capture their daily life activities using ubiquitous technologies. In ubiquitous language learning, the main problem is, to create learning materials, users require to upload their own contextual image for every single word to be learned. Unarguably, determining an appropriate image to represent a word in a right place and in a right context is exceedingly challenging for a user. This problem has reflected in SCROLL's user logs where a significant amount of vocabulary learning logs are created without uploading any contextual image. In the long-run, this may make the learning environment less interactive. Now that our society has transformed into data-driven smart Society 5.0, this problem can be solved by leveraging the power of smart computer technologies such as artificial intelligence, learning analytics, educational data mining, machine intelligence, computer vision etc. Therefore, the present study aims to adopt data-driven approaches to provide a solution to this problem and proposed a distributional semantics model (DSM).

2. The Model

Generally speaking, DMSs are based on the assumption that the meaning of a word can (at least to a certain extent) be inferred from its usage (Evert, 2010). At present, DMSs is a promising technique to solve the lexical acquisition bottleneck by unsupervised learning, and their distributed representation provides a cognitively plausible, robust and flexible architecture for the organization and processing of semantic information (Evert, 2010). In our study, we proposed a DMS model purposing to recommend FCAI images that describe the word most accurately under a specific learning context. Having the objective to development of an intelligent image recommendation system, this model is proposed (shown in Figure 1). With the proposed model, we plan to achieve three original contributions to a great extent. They are: First, with the proposed model, we intend to

quantifying and categorizing the semantic similarities between various educational data. This analysis would allow me to understand the relationship between a word and its visual image features, learning context, geographical location, demographic information, time of learning etc. Second, we plan to analyze a word's image representation with a reflection of a learner's cultural-association and learning context. Here we plan to find unique patterns. Third, by implementing an algorithm, we intend to determine the most appropriate FCAI image that can represent a word most accurately under a specific learning location and learning context. As a part of algorithm implementation, we plan to inherit basis components of AIVAS-IRA algorithms (Hasnine et al., 2017) (Hasnine et al., 2016).

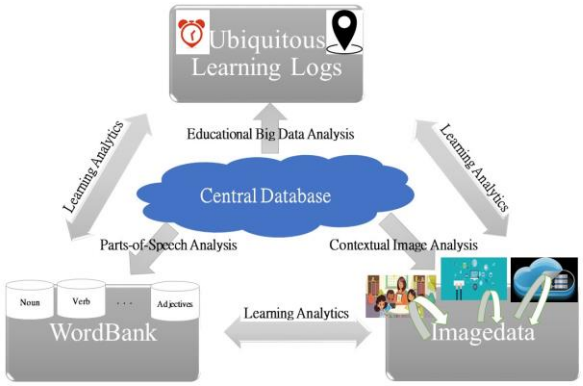

Figure 1: The Distributional Semantics Model for Image Recommendation

3. Preliminary Analysis

We are currently analyzing contextual images that are stored in our central database. Orange[1], a data mining tool is used for the feature extraction, feature analysis, and clustering-related tasks. Inception v3, VGG16, VGG19, and DeepLoc deep architectures are employed for extracting various features from those images. Figure 2 shows the feature extraction and cluster analysis processes in Orange.

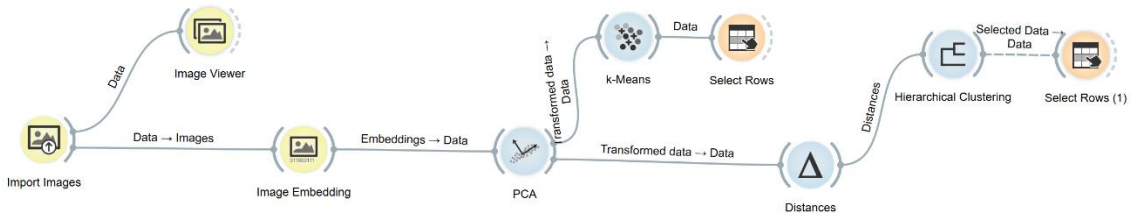

Figure 2: The Process of Feature Extraction and Clustering

4. Conclusion and Future Work

With this research in progress, we aim to develop an intelligent image recommendation system. Also, we aim to solute two commonly encountered problems in foreign vocabulary learning, namely polysemic words, and false-friend detection. For evaluation, the cognitive role of the system recommended images will be measured. Moreover, we plan to evaluate the system by adapting methods like feedback analysis, social network analysis, and motivation measurement etc.

[1] *https://orange.biolab.si/*

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