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Job Recommendation Based on Recurrent Neural Network Approach

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Abstract

Employers couldn't find relevant candidates without great effort, and job seekers must spend a long time researching the right jobs. To fix this issue, recommender systems are an effective way to make talent and job research more effective and easier to complete. It is possible to analyze job offers and candidate profiles and make pertinent recommendations using techniques like the Recurrent Neural Network (RNN) approach. To accomplish this, we propose a model based on the classification of job profiles using a variant of RNN called LSTM ("Long short-term memory"). It is a long-term memory model based on a deep learning algorithm. To maintain the semantic meaning, first, the input of the LSTM model is transformed into a set of vectors using the doc2Vec method, which transforms a document into a vector of numbers.

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1. Introduction

Recruiting the right candidates and looking for a job are very difficult tasks that require a lot of effort and time. Recommender systems can greatly assist in resolving this issue by recommending the right job to the right candidates.

In addition, employers can save time and reduce costs by having fewer applications to process among the most relevant ones given by the recommendation system.

The main objective of this work is to propose a job recommender system based on NLP functionalities and deep learning techniques, more particularly RNN.

In this paper, we first explain the foundations of recommender systems. Then, we present our job recommender system that is based on Text Preprocessing using NLP and LSTM classifiers. Finally, we show the results of the experiment.

2. Recommendation systems

Recommender Systems are machine learning algorithms that deliver the most pertinent items that meet the user's requirements by finding significant features from a large volume of data [1]. They are classified into three types: collaborative filtering recommender systems, content filtering recommender systems [2], and hybrids [3].

Collaborative recommendation systems locate users with comparable requirements and patterns of behaviors. Contrarily, content-based filtering relies on data provided by the user, such as information from his profile.

Hybrid recommendation systems combine the two strategies: user-provided information and user behavior such as ratings or assessments [3].
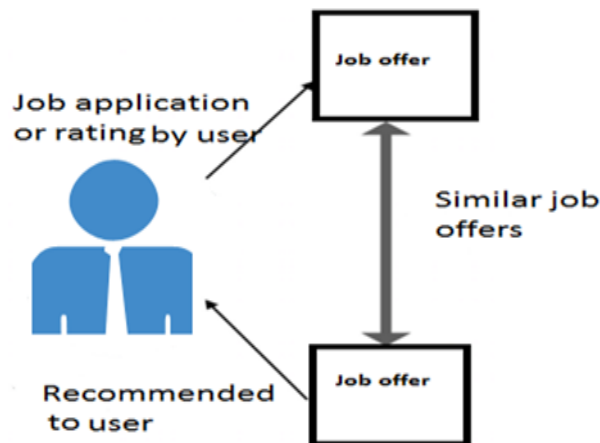

Fig. 1. Example of a job recommendation.

Data collection, data processing, recommendation, and result output are the sequential steps that make up the process of creating a recommender system.

3. Proposed recommender system

As shown in Figure 2, First, the data is cleaned up and irrelevant words are eliminated. The preprocessed data is transformed into vectors of numbers using techniques such as the doc2Vec method [4]. Then, the result is used to classify job offers and resumes into categories using the LSTM classifier. Those categories are used to match similar job offers to similar resumes. According to the literature, the LSTM method is considered to perform better than

other modeling methods [5]. In addition, LSTM solves the problem of "vanishing" and "exploding gradient" encountered in a classical recurrent neural network. [6]
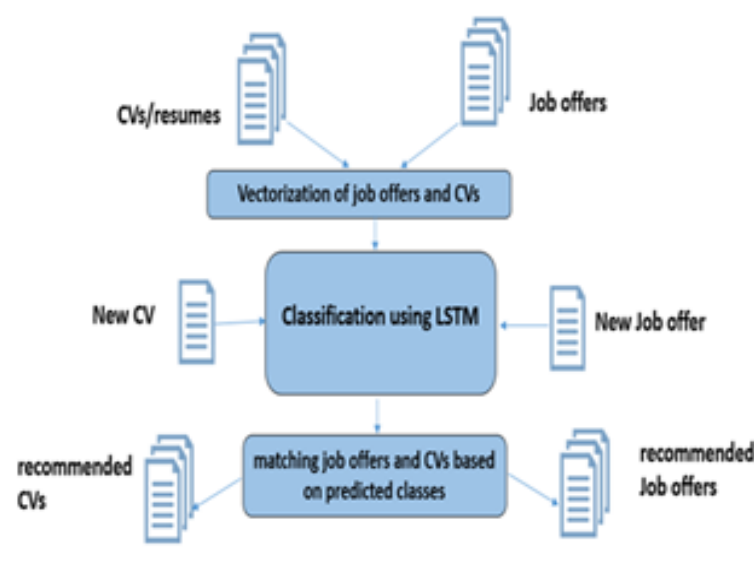
Fig. 2. Job recommendation by matching job offers and resumes.

Web scraping, a method for automatically extracting data from websites, particularly job-related websites is used to collect the data.

The job offer text describes the position details, including all the required skills, qualifications, and work experience. Whereas, the degree title, hard and soft skills, and professional experience, experience duration, languages, hobbies, are all listed on a resume.

Long Short-Term Memory (LSTM) is a special variant of RNN that can learn long term sequences from a text [7]. Three steps can be used to sum up LSTM [8]:

- Discover pertinent past information using the forget gate and the cell state
- Using the input gate, select the inputs that will be important in the long run from the current input. These will be included in the cell state, serving as a lengthy memory
- Use the crucial short-term knowledge from the new cell state to construct the following concealed state through the output gate

Del Vigna et al. showed that LSTMs were more efficient than SVMs for detecting hate speech on Facebook considering three classes "strong hate, weak hate and no hate" [9].
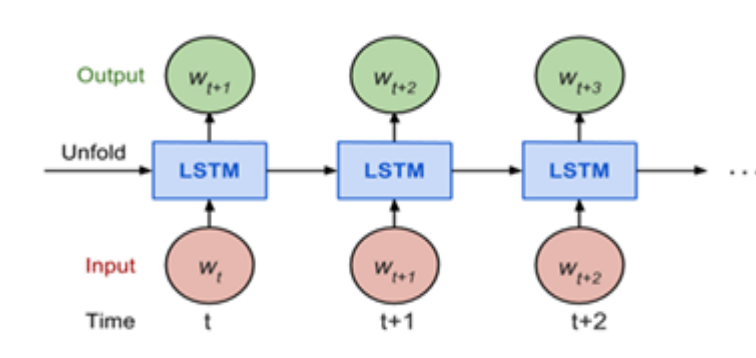
The following figure shows the LSTM algorithm's design.

Fig. 3. LSTM architecture [5].

We used a variety of metrics, including precision, accuracy, recall, and F1 score, to assess our model. [10]

4. Experimental Results

Our dataset consists of the following attributes:
- The job offer Id : Job_Id
- The job offer category: Catagory
- The job offer description: Job_description

We defined the labels for the job category and trained our model using RNN classification.

The activation function used is Softmax because the model is multi-class.

The optimization function used is ADAM (Adaptive Momentum estimation) which is the most used in neural networks for its efficiency and stability.

As Shown in Fig.4 and Fig.5, the evaluation using precision gave good results with a value of 0.986 for the "accuracy" metric and 0.062 for the "Loss" value based on the following hypermeters: Epochs = 10 and Batch_size=64.
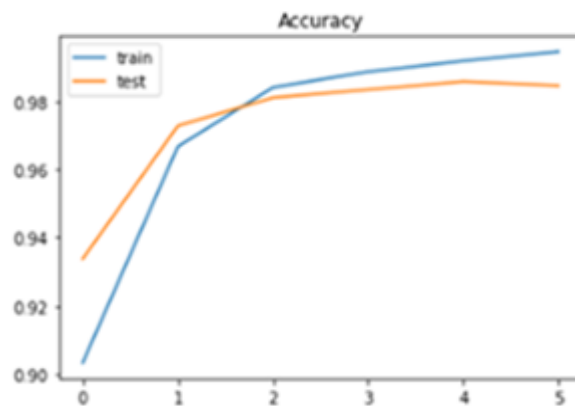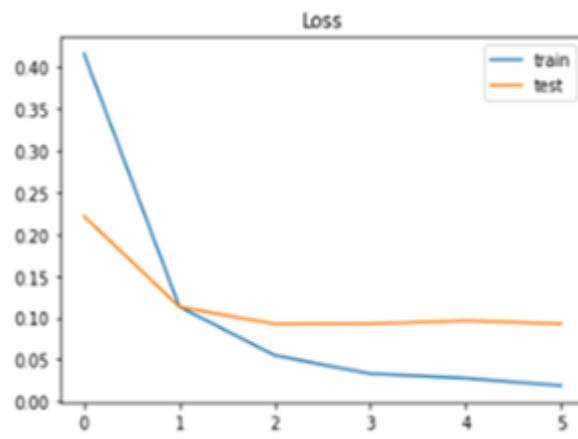

Fig.4. Accuracy results.

Fig.5. Loss Results.

5. Conclusion

In this work, we presented the foundation of our job recommendation system that is based on finding relevant job offers that fit resume using the long-term memory model (LSTM). Before the text analysis phase, data is cleaned and transformed into vectors using text preprocessing techniques and vectorization methods.

According to the results of the evaluation of the LSTM algorithm on our model, we can conclude that this neural network algorithm is significantly better than traditional machine learning methods.

In the future, we intend to compare our model using other RNN variants: BiLSTM and GRU (Gated Recurrent Unit).

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