

Title: AI-Powered Chatbot for Conducting Job Interviews and Reducing Bias in Hiring

Elevator Pitch: Optimize the hiring process with the creation of an AI-powered chatbot that efficiently conducts job interviews, reduces biases, and speeds up candidate screening, using technologies such as NLP, Keras and PyTorch.

Teammates: Gauri Bhandarwar and Pratham Shroff

Context:

The hiring process can be time-consuming and labor-intensive for organizations, with potential biases affecting candidate selection. By leveraging natural language processing (NLP) and deep learning techniques, an AI-powered chatbot can efficiently conduct job interviews and evaluate candidate responses based on various criteria. The implementation of such a chatbot can not only improve efficiency but also reduce biases in the hiring process, leading to more equitable and diverse workplaces.

Topics from list chosen:

Collect your own novel dataset (1 point) and use a NLP framework such as spaCy or NLTK to preprocess questions & candidate responses

Use Pytorch or Keras to try different neural architectures to achieve the best performance on the supervised learning task (2 points) **and/or** train a deep learning model such as LSTM to evaluate responses based on several criteria (2 points)

Language/Tools

We plan to use Python as the programming language for this project due to its extensive support for natural language processing and deep learning libraries. Existing libraries and frameworks we plan to use include TensorFlow & PyTorch for deep learning, and spaCy, NLTK, or Hugging Face's Transformers library for NLP tasks.

While there are existing chatbot projects and libraries available, such as Rasa or Microsoft's Bot Framework, the "value add" of our project comes from tailoring the chatbot specifically for job interviews, reducing biases in candidate evaluation, and integrating it seamlessly into the hiring process. We will focus on creating a unique model that caters to the specific needs of recruiters and organizations, ensuring a more efficient and fair hiring process.

Technical Source:

An online technical resource for this project is the "Natural Language Processing with Deep Learning" course (CS224n) by Stanford University. The course materials, including lecture slides, videos, and assignments, are publicly available on the course website (<http://web.stanford.edu/class/cs224n/>). The class covers NLPs, Keras, and other machine learning and neural network techniques with code examples.

More:

<https://www.analyticsvidhya.com/blog/2021/10/complete-guide-to-build-your-ai-chatbot-with-nlp-in-python/>

Full disclosure

Gauri: I have done no prior work regarding NLPs in prior classes but I have done some research regarding LSTM, which can also be used for sentiment analysis if we see fit to include it in the model. I have also done some hyperparameter tuning recently using gridsearch for a gradient boosting model. These methods of tuning have definitely provided me with experience.

Pratham: While having done no prior work in a similar project, I completed a 2-wk Stanford bootcamp in AI & ML that briefly touched upon most concepts covered in class and took a deeper dive into Computer Vision. I have explored NLP a bit by doing analysis of Amazon Reviews as part of my CS506 midterm using kNN, Decision Trees etc but was forbidden to use deep learning models in which I hope to gain experience through this project (and DS340). I feel confident that I would be able to learn some new concepts and, complemented by Gauri's support and experience, develop something that may have real world applications.

Proposed evaluation

To evaluate the success of the proposed AI-powered chatbot for conducting job interviews, we can use a combination of quantitative and hypothetical qualitative metrics:

Quantitative Metrics:

1. **Model Performance:** Assess the chatbot's performance using evaluation metrics such as accuracy, F1 score, and area under the ROC curve (AUC-ROC) for classification tasks, or mean absolute error (MAE) and root mean squared error (RMSE) for regression tasks.
2. **Bias Evaluation:** Analyze the chatbot's evaluation of candidates for potential biases using fairness metrics like demographic parity, equal opportunity, and equalized odds. These metrics will help quantify how fairly the chatbot is treating candidates from different demographic groups.

3. Time Savings: Measure the reduction in time spent on candidate screening and evaluation by recruiters, comparing the time spent before and after the chatbot's implementation.
4. Number of Qualified Candidates: Track the number of qualified candidates identified by the chatbot, assessing if the chatbot effectively filters candidates who meet the hiring criteria.

Hypothetical Qualitative Metrics (For future improvement)

1. Recruiter Feedback: Gather feedback from recruiters on the chatbot's effectiveness, ease of use, and the quality of insights provided, which will help identify areas for improvement and measure overall satisfaction.
2. Candidate Experience: Collect feedback from candidates who have interacted with the chatbot during the interview process, evaluating their experience in terms of engagement, ease of use, and overall satisfaction.
3. Diversity and Inclusivity: Monitor changes in workforce diversity (e.g., gender, race, and ethnicity) after implementing the chatbot, to assess its effectiveness in reducing biases and promoting a more inclusive workplace.

Plan and Project Timeline

Stage 1 (Data collection and preprocessing): 1 week

Stage 2 (Model development and bias reduction): 1 week

Stage 3 (Model evaluation and optimization): 1 week

Phase 4 (Chatbot deployment and user interface development): 1 week

Deliverables

Stage 1 - Data collection and preprocessing: Gather relevant datasets, such as job descriptions, interview questions, and candidate responses, to train and evaluate the chatbot. Preprocess the data by tokenizing and cleaning text, as well as converting categorical variables into numerical representations.

Stage 2 - Model development: Design a deep learning model for the chatbot, incorporating NLP techniques such as word embeddings (e.g., Word2Vec, GloVe), and sequence models (e.g., LSTMs, Transformers). Train the model to understand and generate contextually appropriate questions and evaluate candidate responses based on the predefined criteria.

Stage 3 - Bias reduction: Implement techniques to reduce potential biases in the chatbot's evaluation of candidates, such as:

- a. Ensuring diverse training data that includes a wide range of candidate backgrounds and experiences.
- b. Using debiased word embeddings or pre-trained models designed to minimize biases.
- c. Regularly auditing the chatbot's performance to identify and address potential biases in its evaluations.

Stage 4 - Think of proper ways to potentially create a user interface and deploy the chatbot in a manner that is easily accessible and customizable based on individual needs.