SCHOOL OF COMPUTER TECHNOLOGY

AASD 4016, Full Stack Data Science Systems

Topic
AI Cover Letter Generator

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Introduction

In the rapidly evolving job market, the ability to stand out amongst countless applicants has become increasingly challenging, particularly in how potential candidates present their qualifications through cover letters. The AI Cover Letter Generator Job Post Killer, addresses this critical need by automating the creation of personalized and compelling cover letters that are specifically tailored to individual job descriptions. By leveraging the latest Large Language Models(LLMs, the tool ensures that each cover letter is not only tailored to specific job descriptions but also highlights the unique skills and experiences of the job seeker, significantly enhancing their chances of securing an interview.

Recognizing the common struggles that job seekers face, especially recent graduates and career changers who may not be familiar with the nuances of effective personal branding, Job Post Killer aims to democratize the job application process. The AI Cover Letter Generator simplifies the tedious task of cover letter writing and equips users with a powerful tool to overcome the barriers posed by automated screening processes used by many employers today. This initiative reflects a broader commitment to using technology to create actionable solutions that facilitate employment opportunities in a competitive job landscape.

Problem Statement

In today's job market, writing a compelling and personalized cover letter remains a significant hurdle for many job seekers. A key issue is the time and effort required to write a cover letter that not only resonates on a personal level but also aligns perfectly with the job's unique requirements—a task that is often daunting for individuals who are not adept in personal branding. Furthermore, the prevalence of generic cover letters diminishes the opportunity to showcase one's distinct qualifications, leading to a homogenized pool of candidates. Compounding this issue is a widespread lack of awareness or disregard for optimizing cover letters to pass Applicant Tracking Systems (ATS), which are designed to screen applications and can inadvertently eliminate qualified candidates before a human eye ever reviews their credentials. This gap in the job application process calls for an innovative solution capable of guiding applicants through creating personalized, impactful cover letters that satisfy both human and algorithmic scrutiny.

ML Canvas
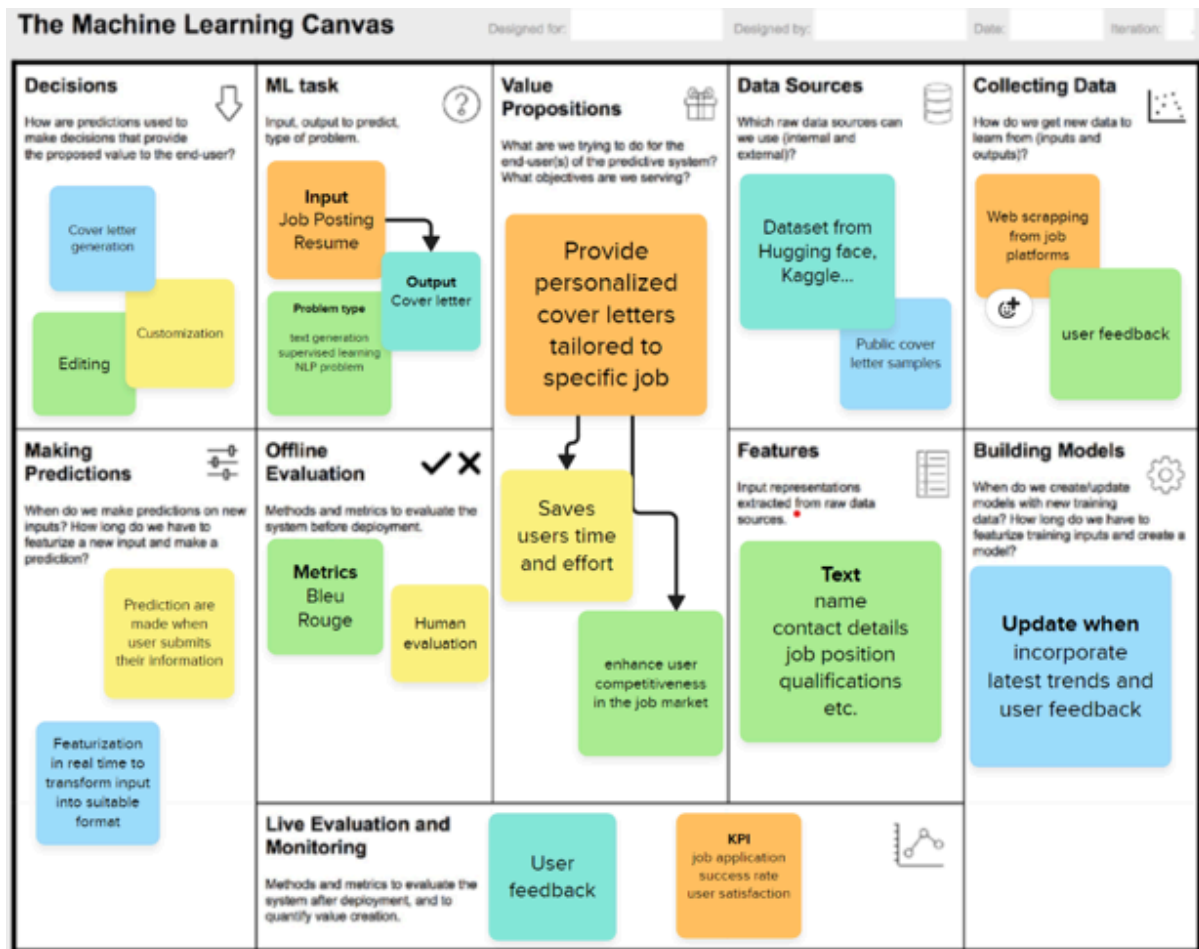
Our project's backbone is the meticulously crafted Machine Learning (ML) Canvas, which serves as a strategic blueprint for developing the AI Cover Letter Generator. Here is an overview of the key components and processes:

Decisions - The ML Canvas begins with the Decision, which is crucial in defining the direction of our machine learning task. We have identified 'cover letter generation' and 'editing/customization' as the primary offerings, driving the development to meet these core user needs.

ML Task - Next is the ML Task. Our ML model ingests two main inputs: job postings and resumes. These inputs are then processed to perform the task of natural language generation, ultimately outputting a personalized cover letter tailored to the specifics of the job and the applicant's professional profile.

Value Propositions - Our value propositions are clearly outlined, emphasizing the ability to provide personalized cover letters tailored to specific job positions. The service aims to save users time and effort, thereby enhancing their competitiveness in the job market.

Data Sources - The Data Sources are diverse and robust, comprising datasets from reputable sources such as Hugging Face, enriched by public cover letter samples. This dataset ensures a rich training ground for our model.

Collecting Data - The Collecting Data segment details our approach to data acquisition. We will employ web scraping to gather job descriptions and feedback mechanisms to incorporate user responses into the model's learning process.

Features - The model's features are built from text representations extracted from job descriptions and resumes. These features include job details and applicant qualifications, ensuring each generated cover letter is pertinent and unique to the job seeker's experience and the job's requirements.

Building Models - Model building is an iterative process, adapting to incorporate the latest trends and feedback. By consistently updating the model with new data, we ensure it remains effective and up-to-date, providing users with a tool that evolves with the job market.

Making Predictions - Cover letter generations are made in real-time, transforming user inputs into customized cover letters as soon as the user provides their information. The system is calibrated to make these predictions efficiently and accurately.

Offline Evaluation - The model's performance is evaluated offline using established metrics like BLEU and ROUGE, as well as through human assessments. These evaluations ensure that the cover letters meet high standards before they are generated for users.

Live Evaluation and Monitoring - Live Evaluation and Monitoring are conducted through user feedback and key performance indicators (KPIs), which include job application success rate and user satisfaction. These metrics inform ongoing improvements and adaptations to the service.

This ML Canvas encapsulates the strategic framework that guides our AI model's development and deployment, ensuring that our Cover Letter Generator remains a state-of-the-art tool in the job application process.

Model Benchmarks

```
Epoch 95/100
325/325 [==============================] - 51s 157ms/step - loss: 0.0064 - accuracy: 0.4718 - val_loss: 1.8290 - val_accuracy: 0.4391
Epoch 96/100
325/325 [==============================] - 51s 158ms/step - loss: 0.0078 - accuracy: 0.4716 - val_loss: 1.8015 - val_accuracy: 0.4379
Epoch 97/100
325/325 [==============================] - 51s 158ms/step - loss: 0.0048 - accuracy: 0.4719 - val_loss: 1.8407 - val_accuracy: 0.4385
Epoch 98/100
325/325 [==============================] - 51s 158ms/step - loss: 0.0071 - accuracy: 0.4716 - val_loss: 1.8266 - val_accuracy: 0.4390
Epoch 99/100
325/325 [==============================] - 51s 158ms/step - loss: 0.0079 - accuracy: 0.4715 - val_loss: 1.7924 - val_accuracy: 0.4387
Epoch 100/100
325/325 [==============================] - 51s 157ms/step - loss: 0.0063 - accuracy: 0.4718 - val_loss: 1.8424 - val_accuracy: 0.4376
```

Our AI Cover Letter Generator has been rigorously benchmarked to ensure it meets the high standards necessary for effective performance in a real-world setting. The model underwent a series of evaluations, where both precision and fluency of the generated text were critically assessed using widely recognized metrics.

```
warnings.warn(_msg)
evaluation scores: {'bleu': 0.13723502622214614, 'rouge': {'rouge-1': {'r': 0.36013365740753445, 'p': 0.9073787876793122, 'f': 0.4946354892943846}, 'rouge-2': {'r': 0.2685385171386128, 'p': 0.8207615129904241,
```

The evaluation scores demonstrate the model's linguistic capabilities, with a BLEU score of 0.137, indicating a fair degree of precision in generating cover letters that are syntactically aligned with the expected output. Additionally, the ROUGE scores provide insight into the text's quality, with ROUGE-1 achieving a recall of 0.361 and a high precision of 0.907, suggesting that the generated cover letters closely match the reference data in terms of word choice and order. The ROUGE-2 score, while generally lower, still reflects a reasonable ability to replicate two-word phrases from the reference data, with a precision of 0.827, highlighting the model's grasp of common collocations in cover letter writing.

Over the course of 100 epochs, the model displayed steady improvement, as reflected in the loss and accuracy metrics. The training loss decreased from initial values, stabilizing around 0.0063, which is indicative of the model's learning efficiency. Correspondingly, the accuracy plateaued at approximately 47.18%, underscoring the model's consistent performance. The validation loss and accuracy scores provided further evidence of the model's robustness, with validation accuracy remaining close to the training accuracy, which suggests that the model generalizes well to unseen data.

The final epochs of training solidified the model's performance, with minimal fluctuations in accuracy, signifying a convergence in the learning process. This steady state of the metrics indicates a well-trained model that has reached its learning potential under the current configuration and dataset.

Deployment

User Interface with Streamlit

To provide an intuitive and responsive user interface, we utilized Streamlit, which is specifically tailored for machine learning and data science applications. Streamlit offers a straightforward method to turn data scripts into shareable web apps, enabling us to focus on perfecting the backend logic while delivering a polished and user-friendly frontend experience.

Docker

We adopted Docker for containerization, which encapsulates the application and its dependencies into a container that can be uniformly deployed across different computing environments. Docker facilitates ease of updates, consistent performance irrespective of the host system, and a streamlined development-to-production workflow.

Cloud Hosting on AWS

Leveraging the scalability and robustness of cloud computing, we chose Amazon Web Services (AWS) for hosting our application. AWS provides the necessary infrastructure to handle varying loads with reliability and cost-efficiency. This choice ensures that our service remains responsive and available, accommodating the fluctuating number of users without service interruption.

Challenges and Future Enhancement

Our AI Cover Letter Generator faced two main challenges: limited training resources which constrained model development, and initial underperformance in personalization of the cover letters. In response, we've charted out several enhancements to refine our application:

Enhance Personalization: Introduce more granular personalization to better tailor cover letters to individual users.
Improve Model Performance: Ongoing training with expanded datasets to boost the model's understanding of job requirements and user profiles.
Advanced Data Extraction: Develop sophisticated data extraction methods for improved input accuracy.
User Feedback Integration: Implement a feedback system to capture user satisfaction and guide iterative improvements.

These steps are aimed at not just overcoming the current limitations but also elevating the overall effectiveness of the cover letter generator.

Conclusion

In conclusion, the AI Cover Letter Generator represents a significant leap forward in the job application process. Developed in response to the rising challenges faced by job seekers, especially recent graduates and career changers, our tool addresses the critical need for personalized and ATS-optimized cover letters. With the job market's growing demand for precision-targeted applications and the rise in remote job applications, our solution stands out by offering a unique blend of job description analysis and integration of the user's employment history.

The AI Cover Letter Generator not only reduces the application time for job postings but also significantly enhances the relevance of cover letters, thereby increasing the chances of passing through ATS filters. Despite facing challenges such as limited training resources and initial model underperformance, our dedicated team has outlined a clear path for future enhancements that promise to further improve personalization, performance, and user satisfaction.

As we look ahead, we are confident that the AI Cover Letter Generator will continue to evolve, informed by user feedback and enhanced model performance, to remain at the forefront of helping job seekers secure their desired positions. The commitment of Job Post Killer to innovation and user empowerment is unwavering, and we are excited to see how our tool will shape the future of job applications.