Expert system for predicting startup success

Roman Čech
Tomas Bata University in Zlín, Faculty of Applied Informatics

Abstract

The main objective of this master thesis is to develop an expert system using the system Drools that can estimate the probability of success of pre-seed financial technology startups. It uses a scorecard valuation method. A modern web interface using React improves the user experience. The system mainly serves start-ups that are interested in starting a business and have a clear idea of the product and market they want to conquer. The strength of the application is the communication with the OpenAI server using the GPT-3.5 model, which allows the generation of valuable feedback for the entrepreneur.

Introduction

Valuing a startup is a key but challenging task, especially for first-time entrepreneurs. Common valuation methods consider factors like team strength, financial forecasts, business models, unique value propositions (UVP), and competitor analysis. Getting this right is crucial for securing investments and setting realistic ROI expectations.

Pre-revenue startup valuations are particularly complex and subjective, often relying on experience and intuition. To simplify this, we focus on success probability, a more objective metric based on patterns from successful ventures and industry standards. This approach offers a clearer, less subjective way to assess a startup's potential for success.

Feedback is a critical component of this process. Entrepreneurs need a tool to evaluate their proposition and obtain feedback on areas of improvement before seeking investment or deciding to move forward with their endeavor. Constructive feedback helps identify weaknesses, refine strategies, and increase the likelihood of success in an otherwise uncertain and competitive environment.

Methodology

The score-based assessment methodology, informed by the **Scorecard Valuation Method**, is designed to estimate the value of early-stage and pre-funding startups. This approach emphasizes evaluating specific factors that contribute to a startup's distinctiveness and potential for success.

1. Identification of key factors
Experts identify and outline the factors critical for assessing the startup's potential. These factors include:

- Competitive Environment: Evaluates the startup's positioning relative to competitors.
- Product: Assesses the uniqueness and quality of the product or service.
- Market Opportunity: Measures the potential market size and growth prospects.
- Team Experience: Considers the skills and track record of the startup's team.

2. Comparison with similar companies
The methodology involves comparing the startup with similar companies at the same development stage. This comparison helps establish a benchmark based on the average valuations of comparable startups in the same region and growth stage.

3. Assignment of values
Values are assigned to each identified factor based on expert evaluation and data from comparable startups. The weight assigned to each factor is as follows:

- Competitive Environment: 0% to 8%.
- Product: 0% to 17%.
- Market Opportunity: 0% to 35%.
- Team Experience: 0% to 40%.

Assessment:
The assessment framework for this system was implemented using Drools, a rule-based engine designed to handle complex decision-making processes. In this framework, the knowledge base is organized using binary trees and two types of knowledge:

- **Procedural knowledge**: This describes how to handle problems and guides the decision-making process based on the defined rules.
- **Structural knowledge**: This focuses on the relationships between facts and entities, ensuring that key elements like Team, Product, Market, and Intellectual Property are properly interconnected during the analysis.

The production rules were crafted by transforming expert knowledge into a Drools-compatible format. Forward chaining was the primary inference method, with minor use of backward chaining for specific cases. Rules are prioritized using the salience parameter, ensuring higher-priority rules execute first. Key entities like Evidence, Probability, Hypothesis, and Conclusion were modeled as objects, interacting within Drools to assess startups and provide insights. This structured approach enhances the system’s accuracy and relevance for entrepreneurs.

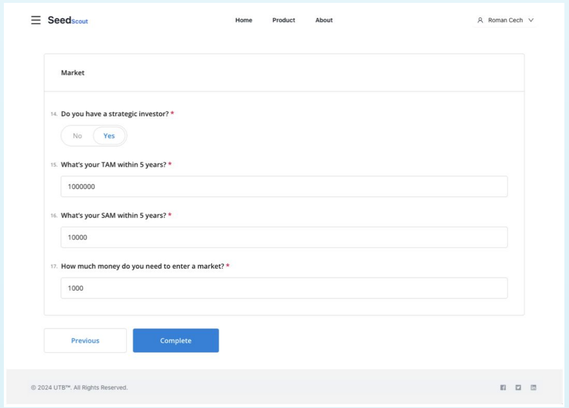
Feedback:
The feedback mechanism leverages GPT to generate useful insights by using the explanations derived from the Drools model. The process involves sending a variable $prompt, which contains the explanation from the Drools model, to a GPT-based endpoint.

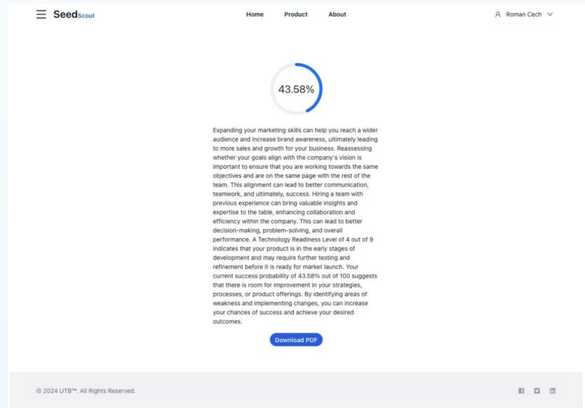
```
curl https://api.openai.com/v1/chat/completions \
  -H "Content-Type: application/json" \
  -H "Authorization: Bearer $OPENAI_API_KEY" \
  -d '{
    "model": "gpt-3.5-turbo",
    "temperature": 0.2,
    "messages": [
      {
        "role": "user",
        "content": "Generate explanation for: $prompt"
      }
    ]
  }'
```

This prompt directs GPT to produce detailed, personalized feedback based on the Drools engine's analysis, helping entrepreneurs understand and enhance their business strategies.

Results

The developed system significantly improves the decision-making of start-ups or entrepreneurs with a clear product and market focus by automating the valuation of the business, estimating the probability of success, and providing personalized feedback. It does not offer end-user decisions or investment advice, but focuses on providing actionable insights to improve business strategies. Feedback is generated and received swiftly, within hundreds of milliseconds, via OpenAPI.





The attached screenshots illustrate the input and output screens. Please note that the input screen is partial.

Conclusion

The system's effectiveness depends on accurate input interpretation. When there is a lack of information or ambiguity in the input, the system's performance diminishes, as it cannot address these uncertainties effectively. Although scoring and expert judgment are crucial for relevance, the system performs optimally with outlier data. Precision can be compromised by ambiguous inputs or insufficient information, and evaluations with mean scores between 3 and 6 on a 1 to 10 scale may exhibit reduced efficiency due to downward scaling.

In comparison to other solutions, this system excels in providing automated business valuations and success probability estimates, offering personalized feedback tailored to entrepreneurs with clear products and markets.

Future iterations could benefit from enhanced precision in handling ambiguous data and integrating a more robust historical data comparison to refine accuracy. Improvements in these areas would strengthen the system’s overall effectiveness and applicability.