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Automatic Question Generation from given Passage using Machine Learning

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ABSTRACT: Automatic question generator is a system that leverages the power of machine learning and Natural Language Processing (NLP) to generate questions from passage provided by the user as input. The system presents a framework for generating authentic questions from unstructured English text. This involves understanding the input text and generating questions using linguistic and machine learning methods. The process includes extracting lexical, syntactic, and semantic information from the text, constructing patterns for each sentence, and using features from these patterns to learn new transformation rules. The approach is data-driven and allows for generating various question types and improving the system through reinforcement learning. The framework also includes a question evaluation module to filter and select high-quality questions. Experiments and tests show that the generated questions outperform other systems and are comparable to human-created questions.

KEYWORDS: Automatic Question Generation, Machine Learning, Natural Language Processing, text processing, nltk

I. INTRODUCTION

Education is moving into the digital environment and e-learning in combination with AI is a very acute topic today (Ashraf and Khan 2017; Colchester, Hagra, Alghazzawi, and Aldabbagh 2017). From a learning point of view, knowledge evaluation is still a problematic part of e-learning. This is because human experts are currently irreplaceable during the knowledge verification phase.

There are multiple systems available in the market in support of education, but the task of question generation is covered barely. The utilization question generation can go far beyond education and learning.

There are various approaches to the task of Automatic Question Generation. We are focusing on pattern matching because thanks to the continuous development of NLP tools, which offers a wide perspective (tools like part-of-speech taggers, named entity recognizers, semantic role labellers, etc.).

The paper is organized as follows. Section II describes related work regarding the question generation process. Different methodologies used are given in Section III. Section IV presents experimental results showing questions generated from sample text. Finally, Section V presents the conclusion.

II. RELATED WORK

[1] This research paper presents an effective survey of automatic question generation (QG) techniques using natural language processing and machine learning approaches. The survey gave us insights into the updating of QG systems, difficulties, and future scope in the field. Also, it mentions the potential uses of QG systems in education and information retrieval. [2] This research paper provides an abstract of natural language generation

tasks, including the automatic question generation process. It discusses various approaches, techniques, and weaknesses in NLG, with a focus on recent updates and applications.[3] This research paper provides a survey of question generation methods, including traditional approaches and the latest advancements using NN models.[4] This survey paper presents an approach to automatic question generation based on sentence structure analysis utilizing an ML approach. The proposed method involves studying the structure of sentences to identify semantics and relationships, which are then used to generate the desired output.

III. METHODOLOGY

1. Objective Test Generation:

Objective Test class generates objective test questions from the input text. The content of such questions would be trivial sentences extracted from the data. NLTK's POS tagger and chunker identifies the nouns and noun phrases in the input for generating questions.

2. Subjective Test Generation:

The Subjective Test class is used to process user-inputted text data and create subjective test questions. Using SpaCy, the passage is segmented into sentences. Then all nouns in sentences are collected. Different type of question are ready for being asked, such as 'Paraphrase the passage into human-sounding text while retaining citations and quotes', 'Explain how modern finance has developed since, compared to early modern Europe', 'How would you define social media?', 'Summarise what you learned', 'Comment upon the main points'. As feedback, the types of questions are provided to give users an idea and complete control over the types of questions to be generated. Furthermore, the program provides users with an option to decide whether the nouns collected should be subjects of the generated questions randomly or up to a certain number of questions asked.

IV. DISCUSSION

1. Test Generation Approach:

The creation of a test takes us through a combination of objective and subjective techniques that collectively forms a holistic evaluation tool. The efficiency and scalability of an objective test complement the critical thinking aspect promoted by the subjective tests. Using NLTK and SpaCy libraries, we customize it to different learning needs to meet the diverse learning objectives. This is how we do it: two birds killed with one stone, striking balance between objectivity and subjectivity.

2. Objective Test Methodology:

The second task that the group undertakes is to create an objective test. In order to do this, we detect simple sentences and nouns using a method that is not based on opinions but on actual data. Instead of nouns we use blanks, thus making a variety of questions— including those where the answer can be found through logical chains— possible with the help of WordNet synsets. This methodology aims at going beyond factual testing, motivating students to think in concepts.

3. Subjective Test Methodology:

Structured around predefined patterns, subjective questions elicit detailed responses from learners. Random noun selection ensures diversity, fostering creativity and critical thinking. SpaCy's linguistic analysis ensures accuracy, empowering learners to articulate ideas effectively.

4. System Implementation:

Implemented using Flask, the system provides a user-friendly interface with functionalities like user registration, login, and test history tracking. Robust error handling mechanisms ensure smooth user interactions. The modular design allows for scalability and future enhancements.

5. Future Directions:

Future iterations could explore integrating machine learning for automatic question generation and assessment. Collaborative test creation features could promote knowledge sharing among educators. Additionally, enhancing adaptability and personalization capabilities would tailor test content to individual learner profiles, pushing the boundaries of educational innovation.



V. EXPERIMENTAL RESULTS

Summary of generated result is as follows :-

	Objective Questions (Total 100)	Subjective Questions (Total 100)
Correct	62	59
Incorrect	38	41
Success rate	62%	59%

VI. CONCLUSION

In conclusion, our automatic question generation project represents an innovative leap forward in educational technology. By effortlessly generating relevant and engaging questions, we empower educators to inspire curiosity and encourage deeper learning experiences for students. Through this innovative tool, we're not just simplifying the teaching process; we're igniting a passion for knowledge and discovery in classrooms around the globe. Together, we're paving the way for a future where learning becomes boundless, where every question sparks a journey of exploration and encourages personal growth.

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