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History Question Classification and Representation for Chinese Gaokao

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We proposed a question representation based on entity labeling and question classification for a automatic question answering system of Chinese Gaokao history question. A CRF model is used for the entity labeling and SVM/CNN/LSTM models are tested for question classification.

The contributions of our work:

- Datasets Annotations

We use a corpus which built with questions in past Chinese Gaokao examination papers of history subject and exercises. And manually annotated their question types and question entities.

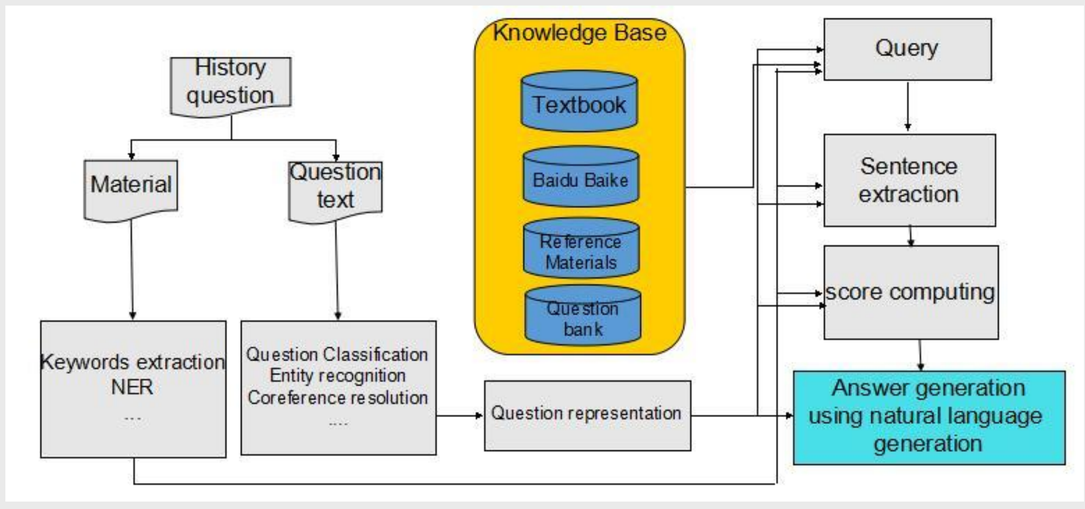
- Question Classification

For the purpose of comparison, we first use a rule-based method which use regular expressions. We choose SVM as our baseline. Then CNN and LSTM are used which works better than SVM.

- Question Entity Recognition

We apply CRF which provide a good performance.

Figure 1. Procedures of answering history material questions



What we are going to do in this paper is classifying the questions of Gaokao history subject, which is the first step of our question answering system as shown in figure 1.

Datasets Annotations

Table I Label of question entity

Type	Description	Example
Material	The index of material	材料一, 材料
Event	The history event	辛亥革命,五四运动
Focus	Key point of question	意义,背景
Person	Person names	伏尔泰,孔子
Location	Locations	中国,欧洲
Time	Time	唐朝,明,19世纪
Organization	Organization	巴黎公社,联合国

Table I shows the 7 kinds of question entities. These are the most import parts with which we can search in the knowledge base more accurately.

Table II Classes of the question

Type	Description	Example
Explanation	Describe or summarize the event or people, some of which needs analysis	据材料三，简析秦国民风变化带来的影响。
Comparison	Compare events or people. Common, difference or both	根据上述材料，比较李鸿章和郭嵩焘主张的异同。
Commenting	Comment on the people or the events	结合材料二和所学知识，评价严复的思想主张。
Open-ended	The answer of this type of questions usually accept multiple kinds of opinions	依据上述材料，你认为当今世界的主题应该是什么?
Judgement	Judge if it is right or which one is most likely to be the answer	材料二中说“北军的胜利，美国的工业大局已定”是否正确?
Cause and Effect	Describe the cause of event or the effect of the event	据材料三，简析秦国民风变化带来的影响。

Table II shows the 6 classes of the history questions. The reason why we classify in this way is that most of the questions need some skills to answer which can help to get a high score in the exam.

Table III Accuracy of question classification on history questions datasets

Method	Accuracy	Macro-F1
Rule-based	81.33%	63.35%
SVM	85.56%	81.16%
CNN	88.84%	83.31
LSTM	90.25%	87.43%

Table III shows that neural networks outperform the SVM method we implemented on the corpus. All of the above machine learning methods work better than rule-based method.

Table IV Accuracy of question entity recognition

Label	Precision	Recall	F1
Material	97.16%	87.05%	87.43%
Event	80.49%	84.62%	82.50%
Focus	83.78%	86.11%	84.93%
Person	89.90%	86.41%	88.12%
Location	86.55%	86.55%	86.55%
Time	82.93%	80.00%	81.44%
Organization	86.49%	84.62%	82.50%

The main difficulty is that most of the history entities are new to the tokenizer. Meanwhile, some words such as ``秦" has multiple meanings, it can be Qin dynasty or country.