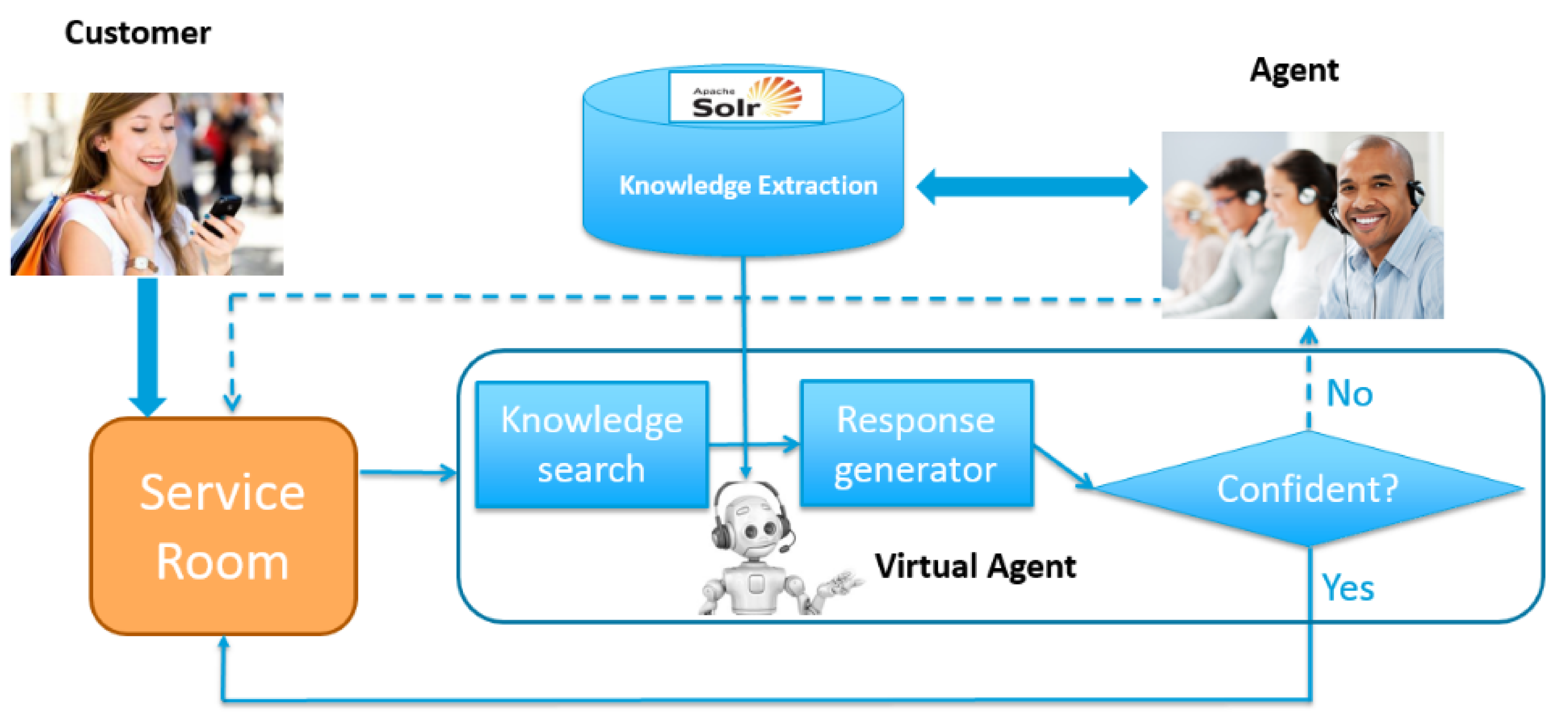
Automatic Question-Answering Using A Deep Similarity Neural Network

Shervin Minaee (New York University) and Zhu Liu (AT&T Labs – Research)

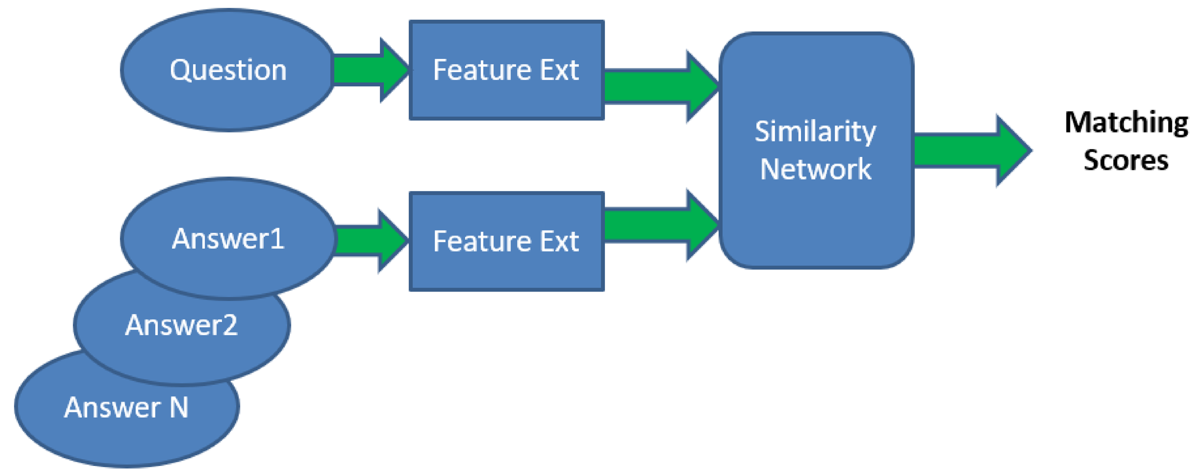
Introduction & Motivation

- In this work we propose a machine learning paradigm for costumer-care automation.
- Traditional costumer-care systems are usually handled by human agents, and there are drawbacks:
  - Long waiting time
  - Repeated questions
  - High business costs
- The automatic one, reduces the cost significantly, and shortens the waiting time.



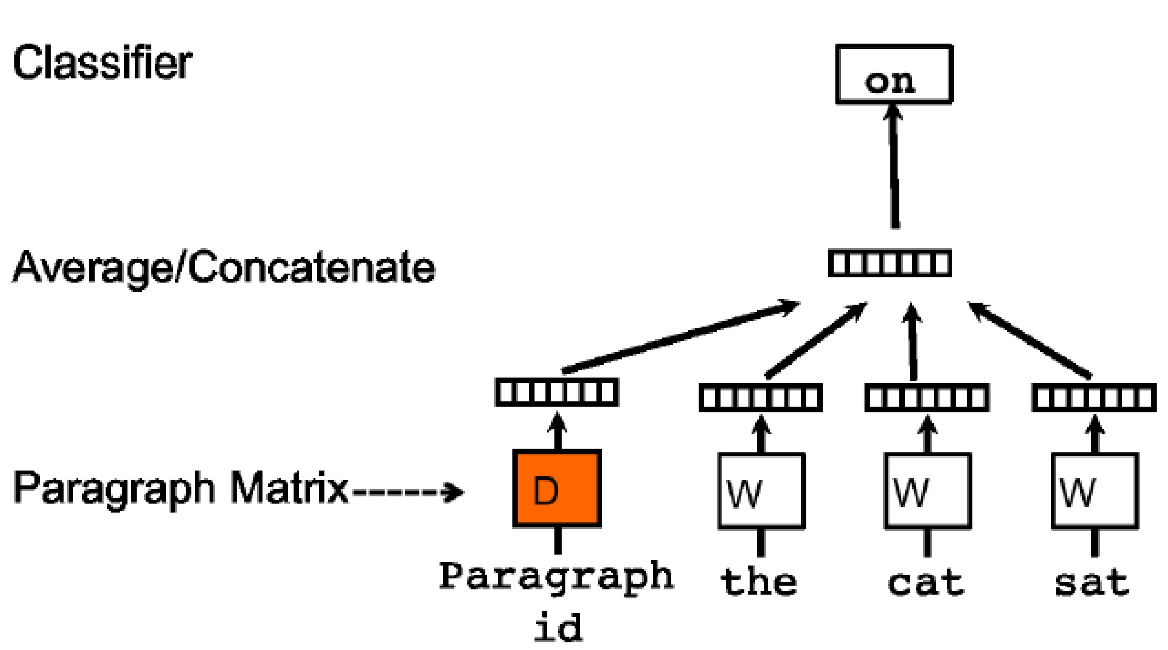
General Idea

- We treat this problem as a form of question-answering task in natural language processing.
- This approach has two major steps:
  - Question and answer embedding.
  - Learning the similarity of questions and answers..



Question/Answer Embedding

- The first step is to learn a mathematical representation of both questions and answers.
- Two major approaches:
  - Bag of word and its extensions.
  - Neural network based embedding.
- Here we used doc2vec approach, which is an extension of word2vec embedding for sentences and paragraphs.
- It starts by a 1-hot vector representation of the words (and paragraphs), and then learns an embedding, in a way that we can predict the current word given its context.
- Its block diagram is shown below:



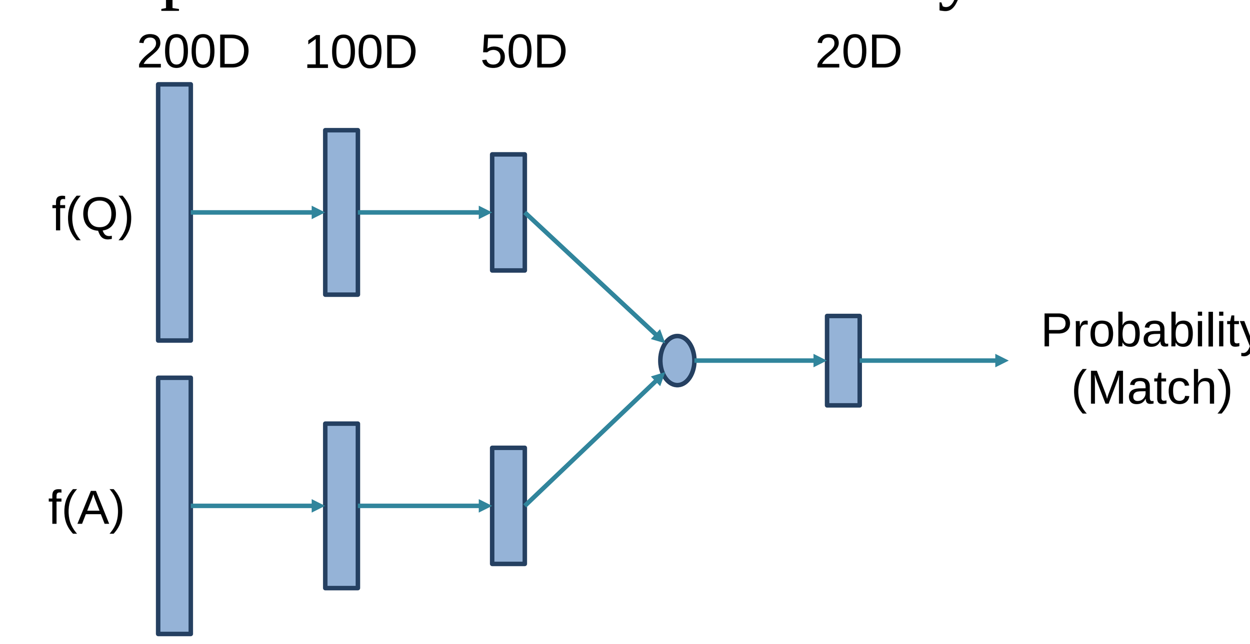
* Doc2vec block diagram, courtesy of Mikolov

- It learns these embedding by maximizing the log-likelihood of current word given its previous and future words as:

$$\sum_{t}\sum_{k} \log p(w_t | w_{t-k}, \dots, w_{t+k}, s)$$

Similarity Learning

- We use the knowledge embedded in the past data to learn how suitable an answer is for a given question.
- We propose a neural network which takes a pair of question and answer embedding as the input and predicts how similar they are.



Experiments

- Evaluation on the Insurance QA dataset, that contains a training set of 12,889 questions, a validation and a test sets of 2,000 questions, with a pool of 100 candidate answers.
- Batch size of 100, and train for 600 epochs.
- Accuracy

Method	Accuracy
Bag of word + SVM	0.72
The proposed algorithm	0.83