



EquGener: A Reasoning Network for Word Problem Solving by Generating Arithmetic Equations

ABSTRACT

In this paper, we present a novel approach to solve simple arithmetic word problems by learning a dense representation of the problem description conditioned on the question. This dense representation is the fulcrum of our approach for generating operands and operators in correct order. Our approach improves upon the state-of-the-art system by 3% in one benchmark dataset while ensuring comparable accuracies in other datasets.

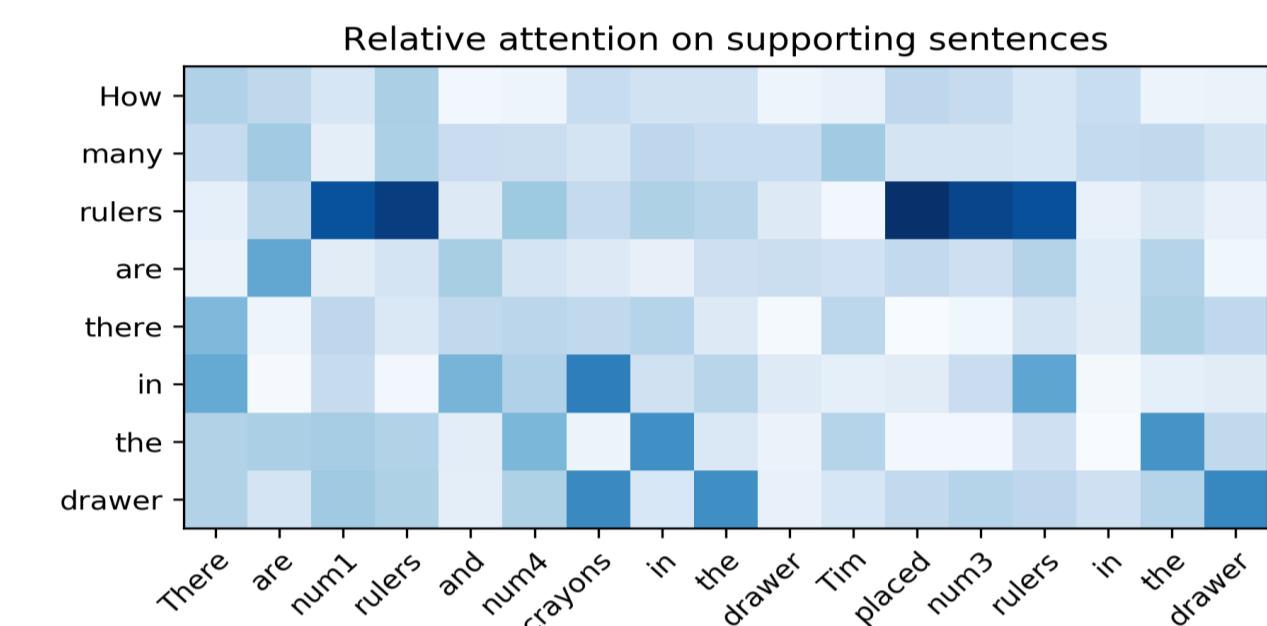
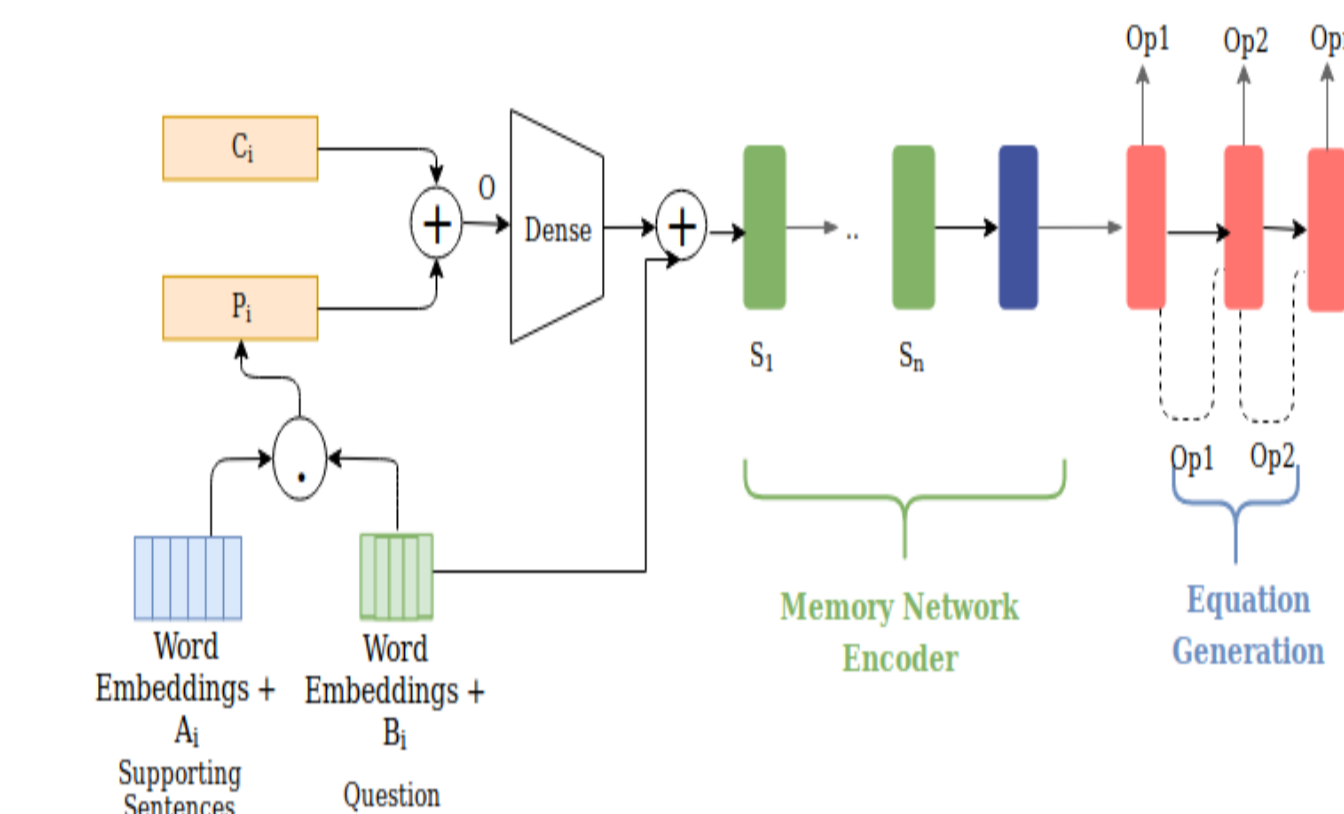
INTRODUCTION

An ideal equation generation system for a word problem should have the capability of identifying all the components of the equation and form the equation in an orderly fashion independent of syntax or vocabulary of the sentences. Previous systems were heavily reliant on hand-crafted features, verb categories or specific template abstractions. In this work, we introduce EquGener - an equation generator using a memory network with an equation decoder. Unlike previous systems, our system handles word problems involving all arithmetic operations.

APPROACH

Each word vector is a concatenated vector representation of pre-trained glove embeddings and the embeddings learned by the network from the training corpus. We used a variant of memory networks capturing the intent of the question while answering the word problems. The word representations in the supporting sentences act as memories and these are weighted as per the question. This weighted combination of memory vectors is then learned by the encoder to obtain a hidden representation of the word sequence appearing in the supporting sentences conditioned on the question words. The decoder then generates the equation conditioned on the encoded hidden representation. We modeled our solver using single as well as multi layer memory networks.

ARCHITECTURE



RESULTS

System	MA1	IXL	Avg Accuracy
ARIS	83.6	75.0	79.3
KAZB	89.6	51.1	70.35
ALGES	-	-	77.0
Roy&Roth	-	-	78.0
Mitra&Baral	96.27	82.14	89.20
Attention Enc-Dec	92.23	71.61	81.92
EquGener-1 hop	91.26	85.19	88.22
EquGener-2 hops	94.18	85.19	89.68

FUTURE WORK

We can also extend our work for word problems with multiple operations which requires the decoder to generate multiple equations. This works can also be extended to handle word problems with 2 or more operators. To handle OOVs, we can explore learning the feature representation of the context where OOVs appear.