Automatic Text Categorization and Solving Mathematical Word Problems

(The simultaneous equations solver)

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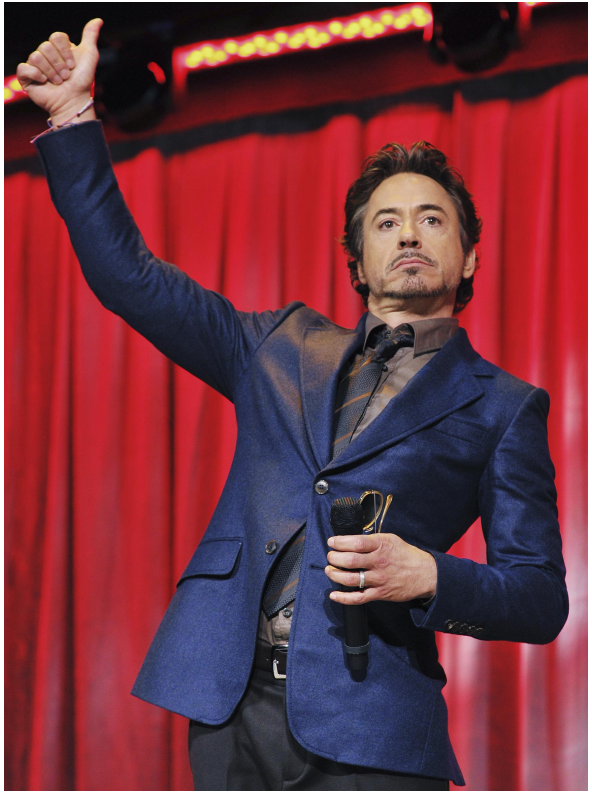
Please, pick a SIDE.!

#Computers



#Humans

Introduction

Problem 1

$$123456789 * 987654321 = ?$$

121932631112635269

Conclusion -

Computers can outperform humans when it comes to **“Calculations”**

Introduction

Problem 2

Today is your birthday. So, I brought you a 2D cake, which has length of 100 units & width of 100 units.

You are only allowed to cut the cake along its length. I'll give you a list of point to make the cuts. If I want to eat the piece with minimum area then what is the length of the piece that you will offer me ?

List of points to make cut : [5, 50, 90, 25]

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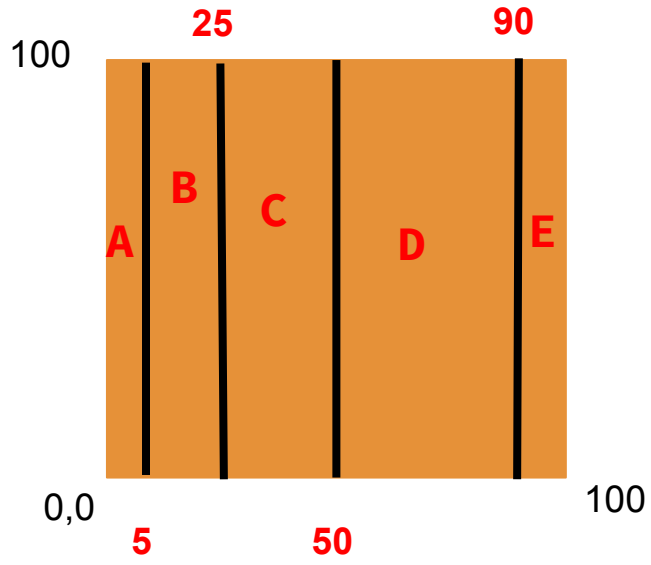
Step 1 : Sort the given list

[5, 25, 50, 90]

This operation will be helpful in finding the length of each slice



Sorted list of points to make cuts: [5, 25, 50, 90]

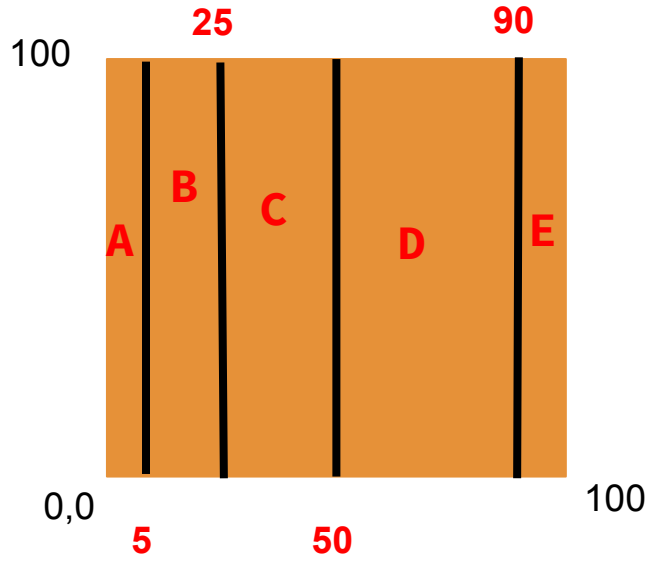
Step 2 : Find the length of each slice

[5, 20, 25, 40, 10]

E.g. length of slice ‘C’

=> (50 - 25)

=> 25

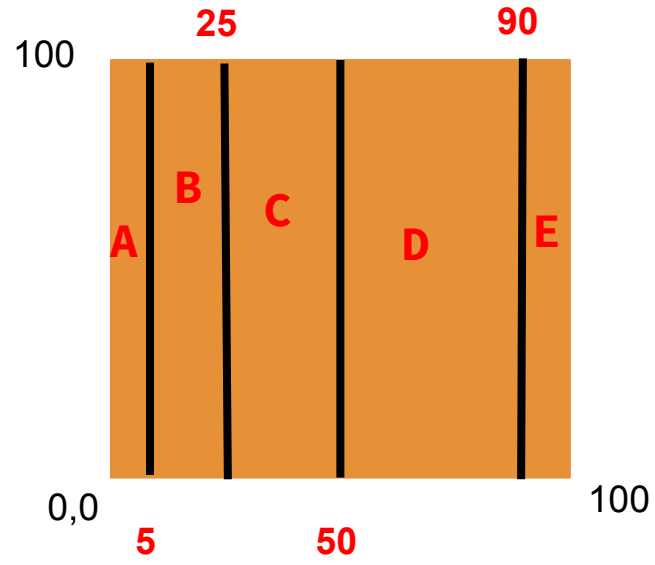


list of length of each slice : [5, 20, 25, 40, 10]

Step 3 : Sort the list of length of each slice

[5, 10, 20, 25, 40]

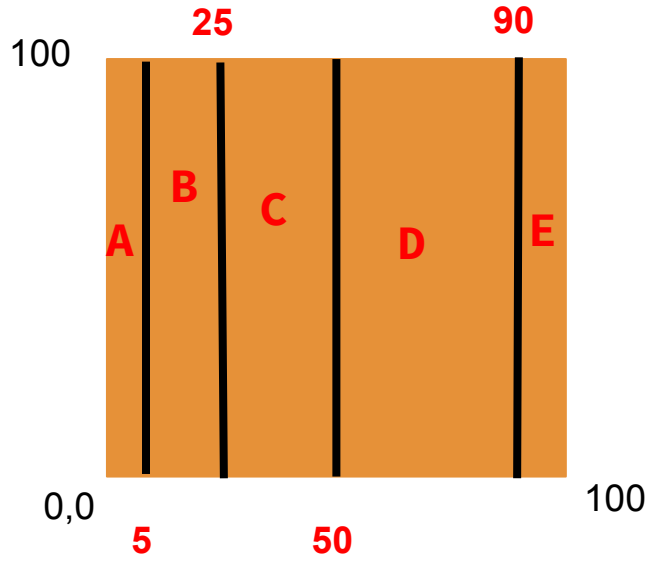
This sorting operation will be helpful in finding the minimum length in the list.



Sorted list of lengths of slices: [5, 10, 20, 25, 40]

Step 4 : First element is the required Result

[5, 10, 20, 25, 40]



Solution : Problem 2

Can computers device this method and get the result on their own ?

Step 1 : Sort the given list of points	**Negative** (Involves Intuition)
Step 2 : Find the list of length of each Slice	**Negative** (Need Result from previous step)
Step 3 : Sort the list of lengths	**Negative** (Involves Intuition)
Step 4 : Find the First element of the list	**Negative** (Need Result from previous step)

Problem - 2

Computational Algorithms

Advance Mathematics and Calculus

Approximate Problem Hirarchy

Statistics

Formula based Problems and Geometry

Algebra

Basic Math word Problem

Problem - 1

Basic Arithmetic Operations

Problem Statement

Can we develop an intelligent system which will complement the legendary and orthodox teaching and learning methodologies used for solving algebraic mathematical word problems ??

Assumptions .. !

- Questions which can be solved with single equation
- Questions will not contain any pronouns
- All sentences will be in Active Voice
- The resultant equation will only contain either **Addition** or **Subtraction** operation

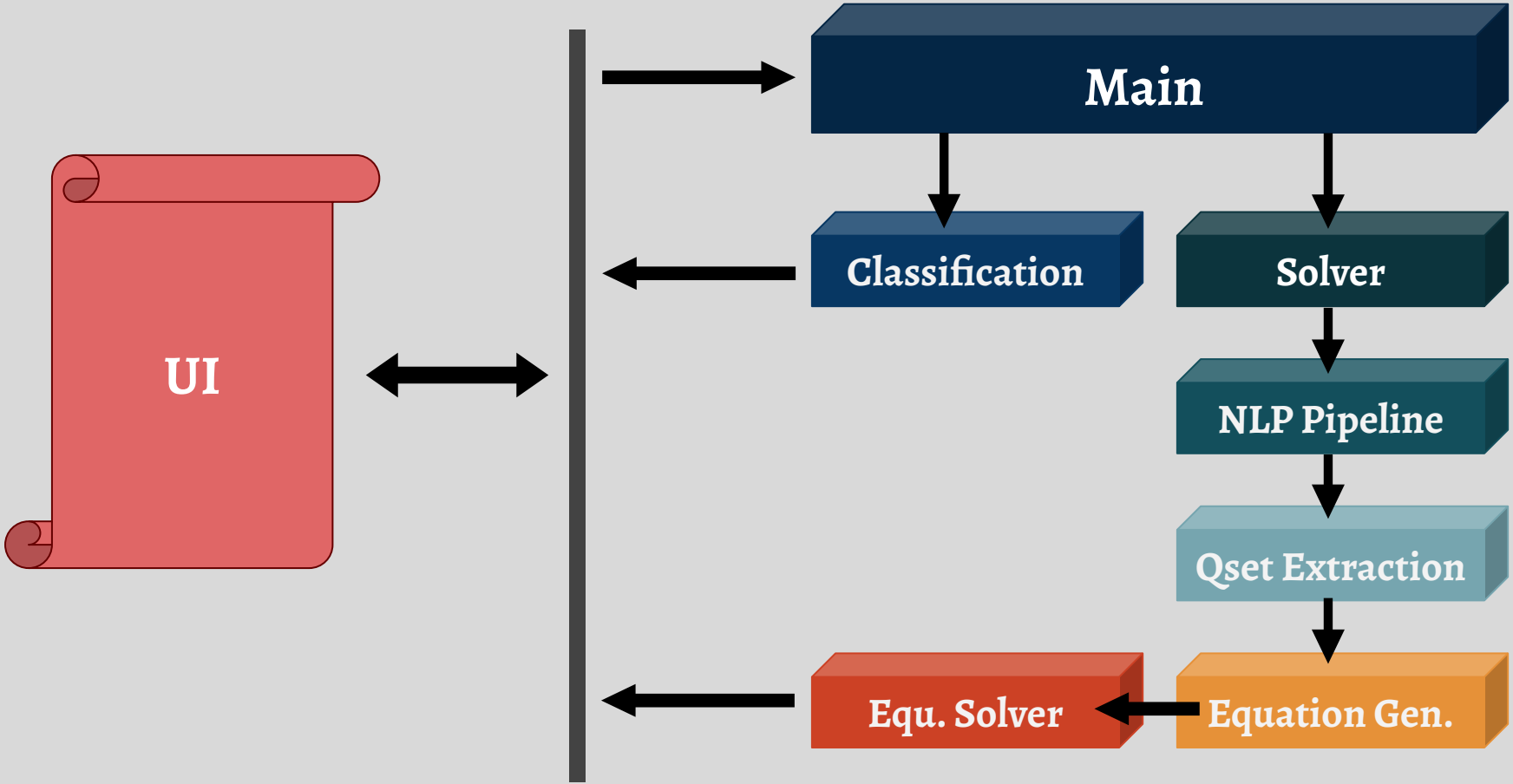
Basic Math Word Problem

Problem 3

Lilly found 70 seashells on the beach . Lilly gave Sam some seashells. Now Lilly has 27 seashell . How many seashells did Lilly gave to Sam ?

Let’s look at the **SYSTEM** that we have built to solve this.. !!

System Architecture



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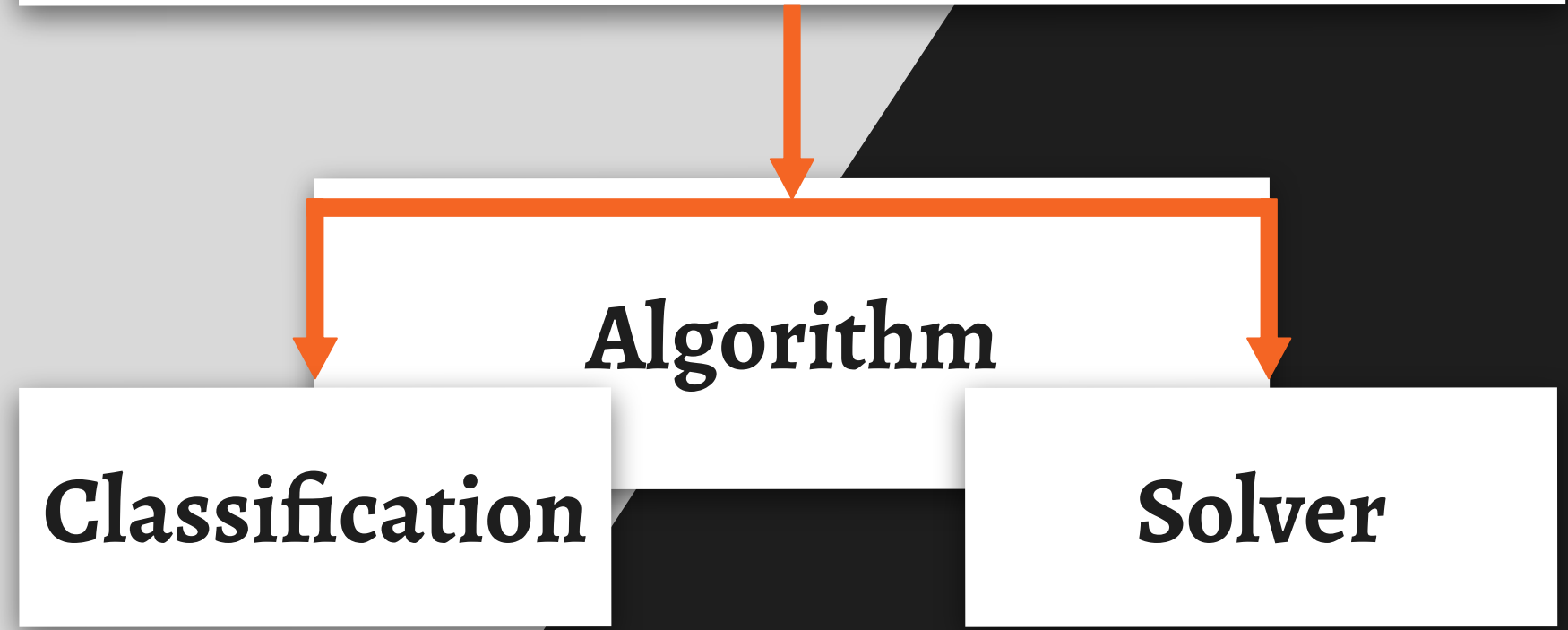

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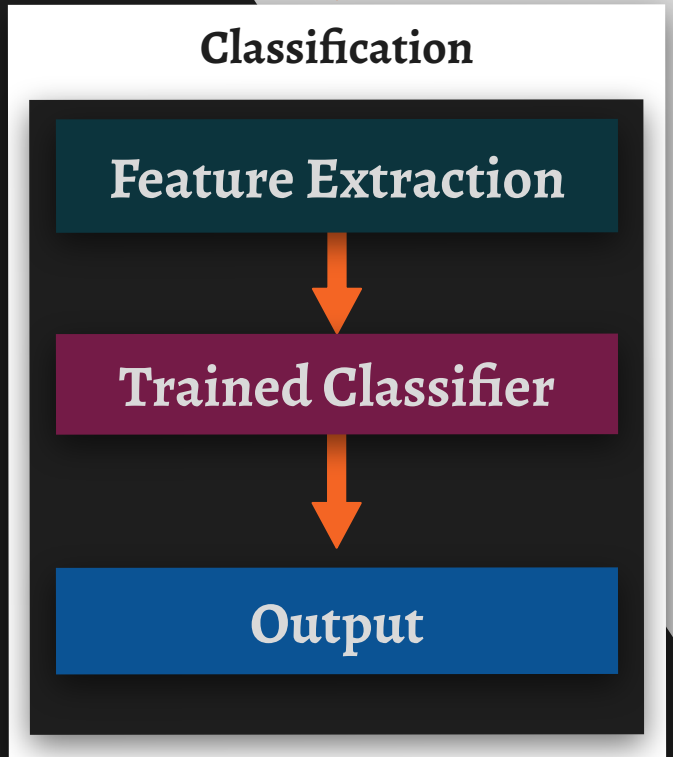

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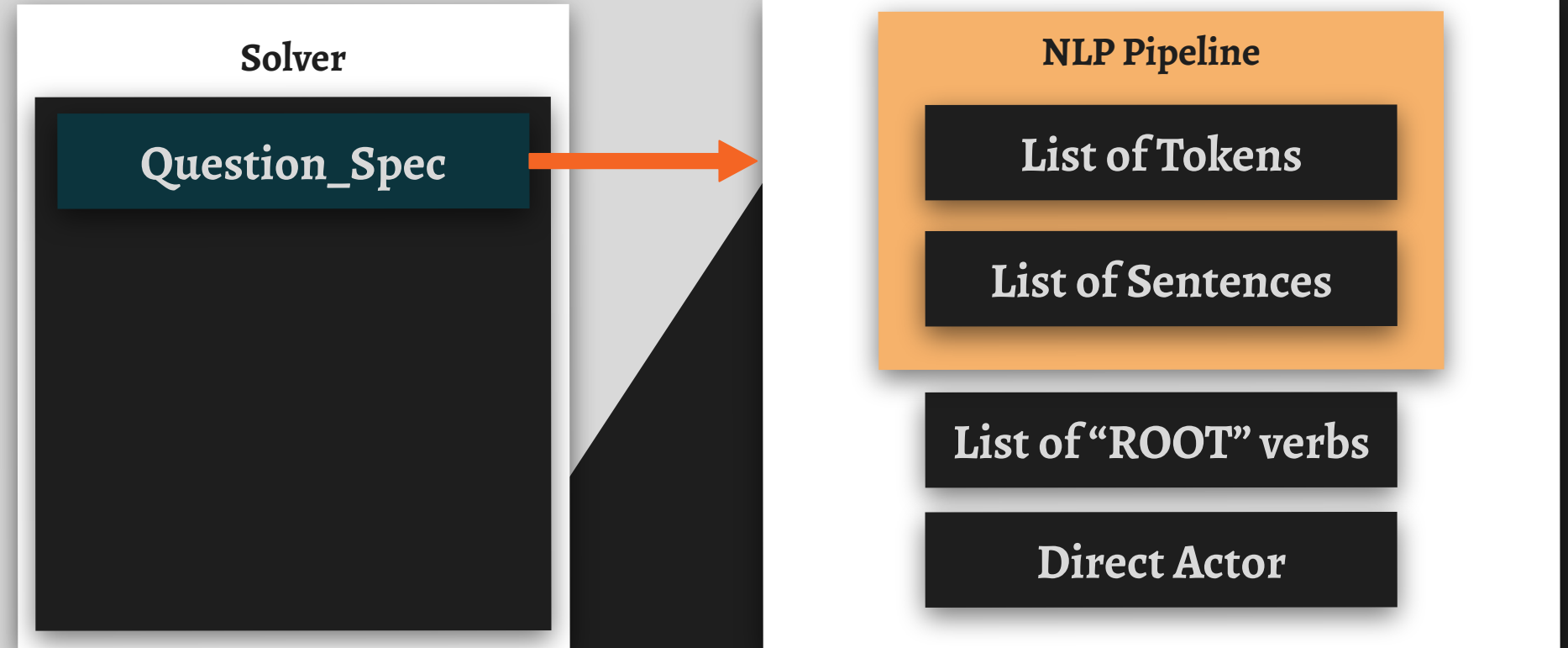

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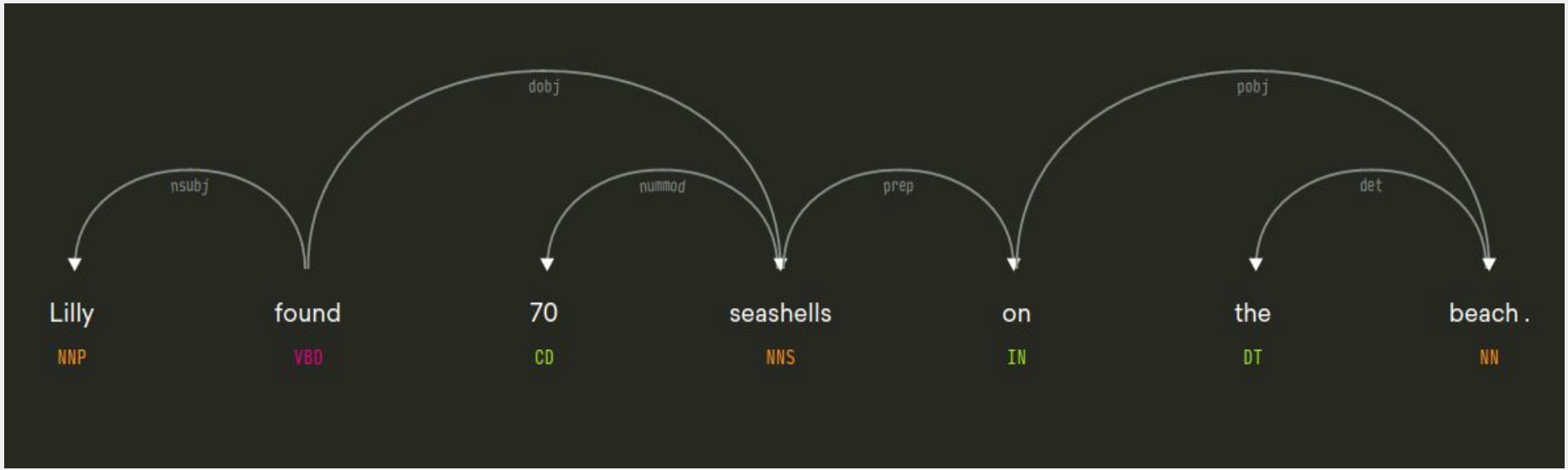
Dependency Tree

(generated by SPACY)



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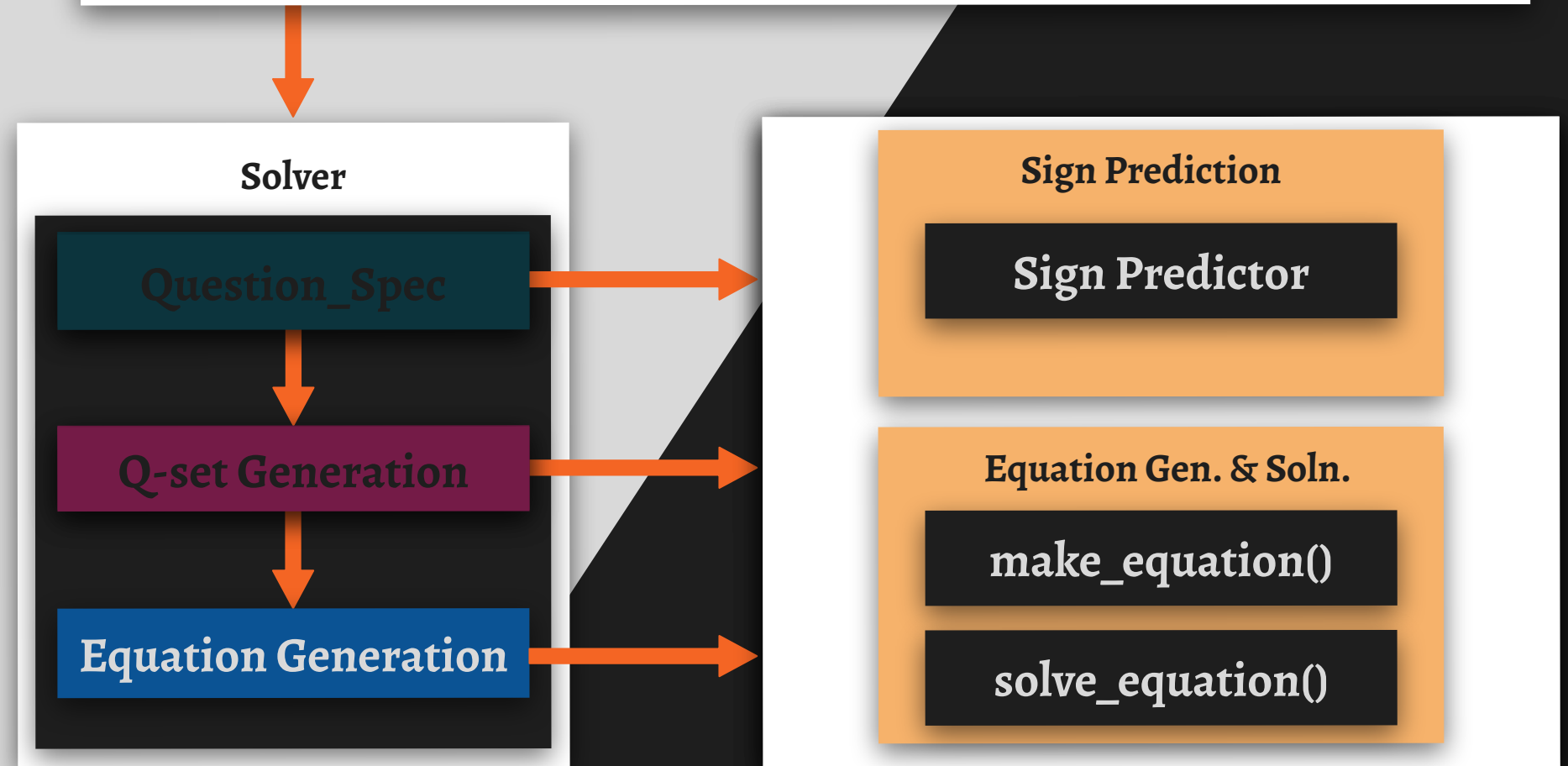

Demo

Technology Stack

spaCy

TensorFlow

pytest

Testing (pytest)

- Detailed info on failing **assert statements**
- Support for **Unittest** module
- Supports **External plugins**
- Grouping of **multiple tests**
- Assert **Exceptions** when raised
- Running **existing test suites**
- **Auto-discovery** of test modules and functions

Challenges

- Hardware Capabilities
- Dataset Availability
- Context identification
- Coreference Resolution
- Study of Deep learning
- Vectorization of Numbers

Other Approaches

- Use of Templates
- Use of State Transition
- Use of DOL

Future Scope

- Problems with complex context
- Higher Order Questions
- Use of Sequence2Sequence models

The Bigger Picture .. ?

Descreption2Code

The (extremely) ambitious goal of this request is to solve the problem of turning descriptions into code. It is outside the reach of current machine learning algorithms. However, ethancaballero has collected 5000 input-output examples of programming challenges. It can be interesting to play with this small dataset, to see whether anything interesting can be achieved with an application of standard supervised learning techniques.

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https://openai.com/requests-for-research/#description2code
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Conclusion

- Our system (Engine) is successful in solving Basic Mathematical Word Problems.
- Our Classification Module yields an accuracy of 86.7%

Thanks .. !