



# SimiHawk: A Deep Ensemble System for Semantic Textual Similarity (SemEval-2016 Task 1)

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## Problem - SemEval Task 1

Semantic Textual Similarity (STS) measures the **degree of equivalence in the underlying semantics** of paired snippets of text.

Range from 0 to 5:

0 - the sentences are completely independent

5 - the sentences are semantically equivalent

### Example\*

Sentence 1: [A Pyrrhic victory](#)

Sentence 2: [Cutting off your nose to spite your face](#)

\* Human annotation: 3.0174

## Approach

Goal: evaluate strengths and weakness of different approaches:

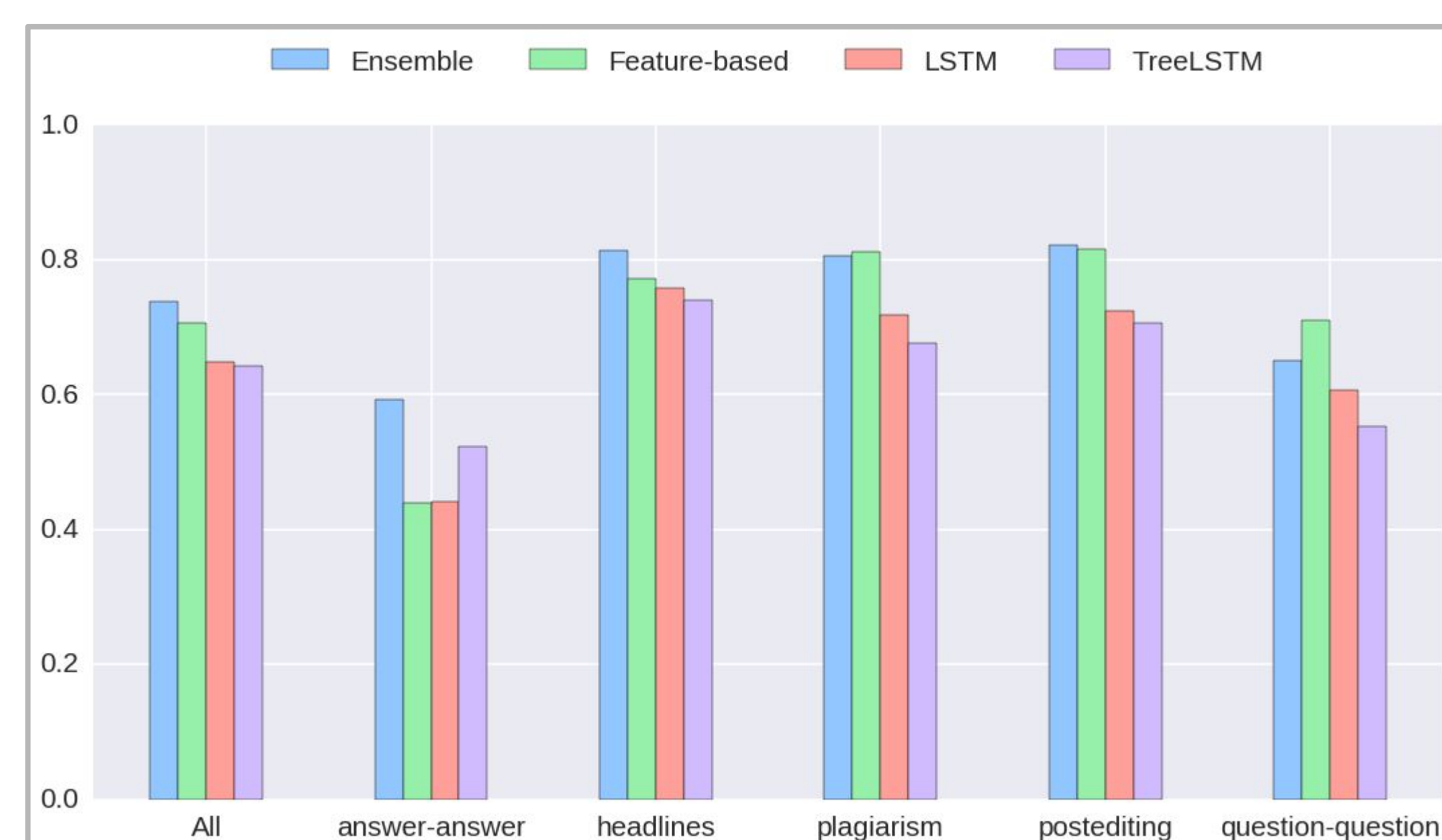
- A classifier with heavily **hand-engineered features**
  - Performed best at last year's challenge
- Two deep **neural network** architectures (learned representation)
  - Conventional LSTM: **recurrent** neural network
  - TreeLSTM: **Recursive** neural network
    - composes the current state from many child units

## Results

	All	answer-answer	headlines	plagiarism	postediting	question-question
Ensemble	<b>0.73774</b>	<b>0.59237</b>	<b>0.81419</b>	0.80566	<b>0.82179</b>	0.65048
Feature-based	0.70647	0.44003	0.77109	<b>0.81105</b>	0.81600	<b>0.71035</b>
LSTM	0.64840	0.44177	0.75703	0.71737	0.72317	0.60691
TreeLSTM	0.64140	0.52277	0.74083	0.67628	0.70655	0.55265

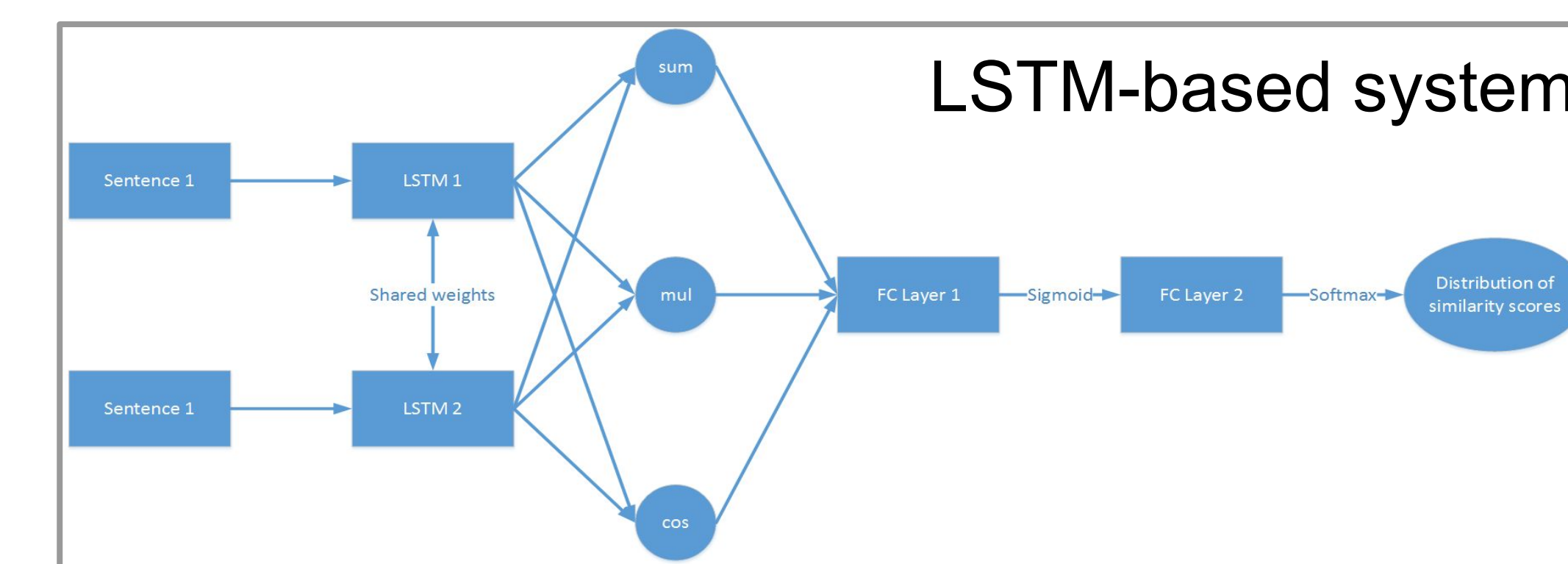
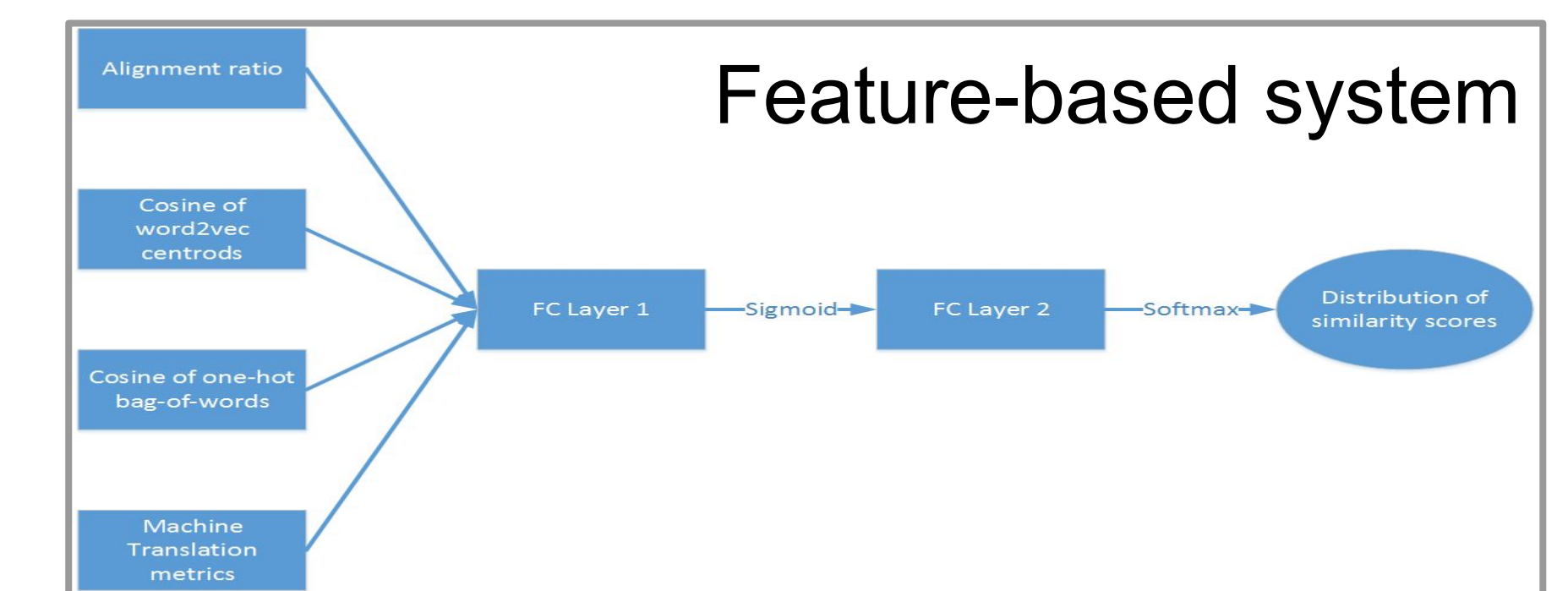
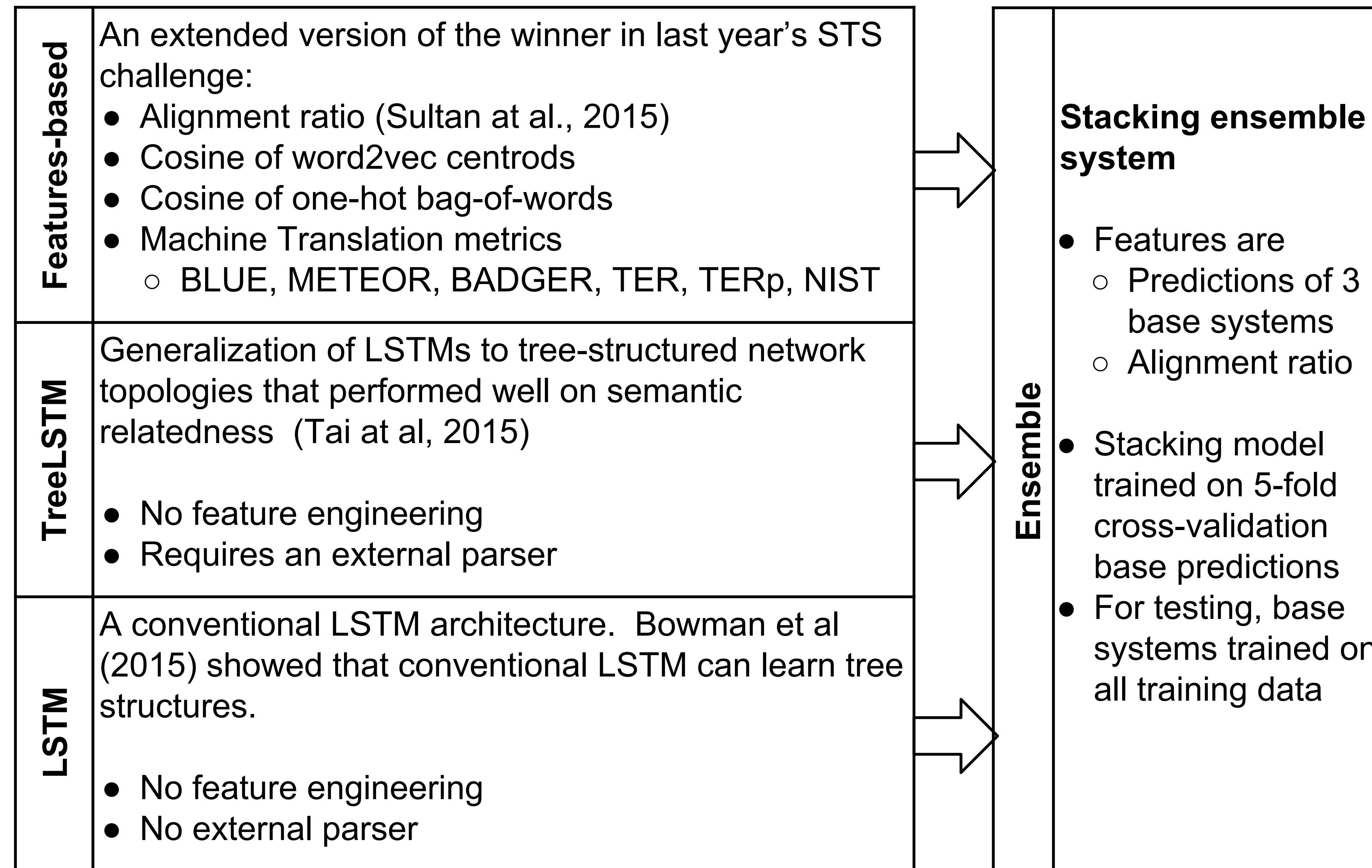
Ensemble: **7 out of 115**

Feature-based: 37, LSTM: 73, TreeLSTM: 77



All systems train on all available data from previous shared tasks -- a total of 13,061 pairs.

## Models



## Discussion

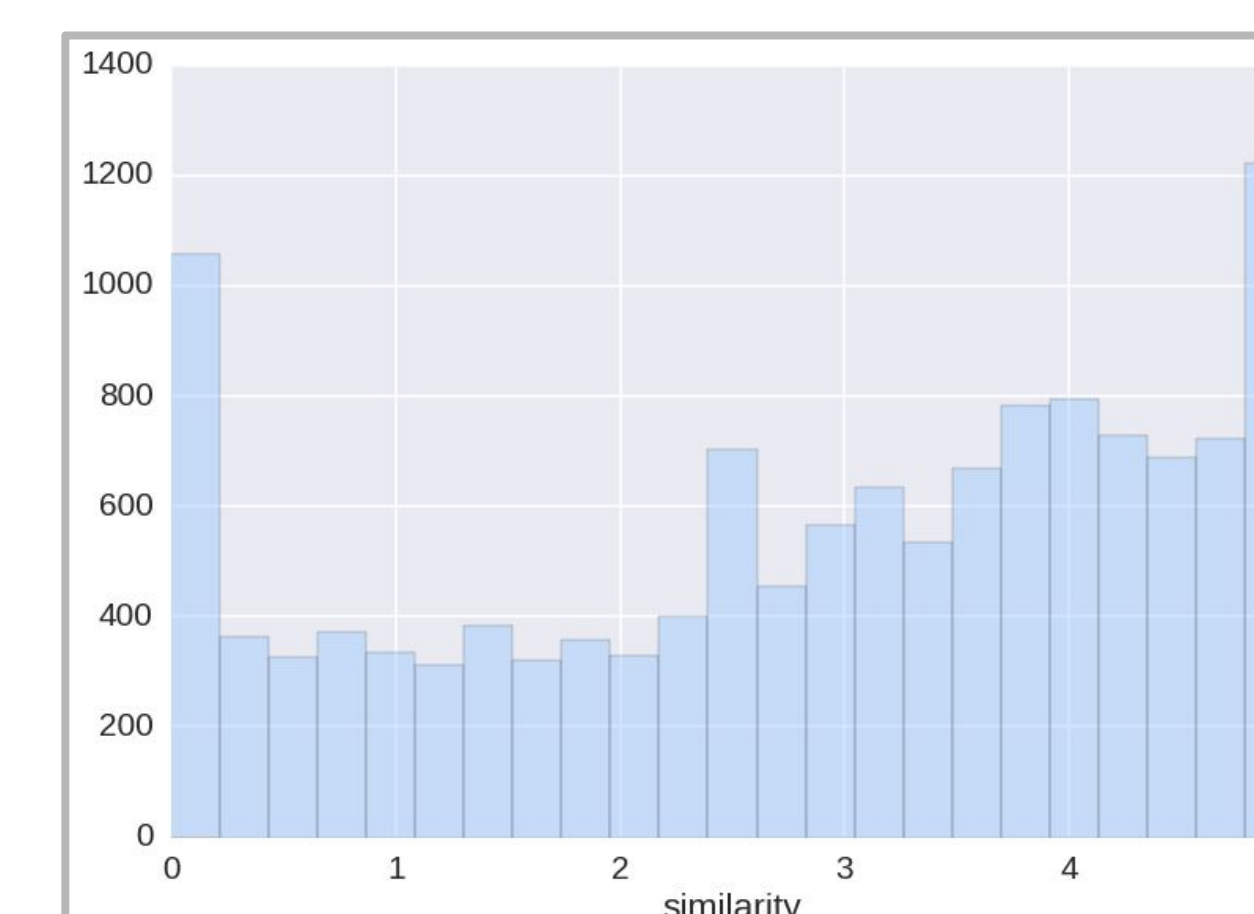
- Results suggest that three base systems have **complementary strengths and weaknesses**, and the ensemble system is able to leverage them to **eliminate noise** in the predictions.
- Feature-based system is the best-performing base system overall
- Ensemble system's predictions have the highest correlation with
  - Feature-based system in two out of five domains
  - TreeLSTM in the other three domains

**Example:** System predictions for a sentence pair

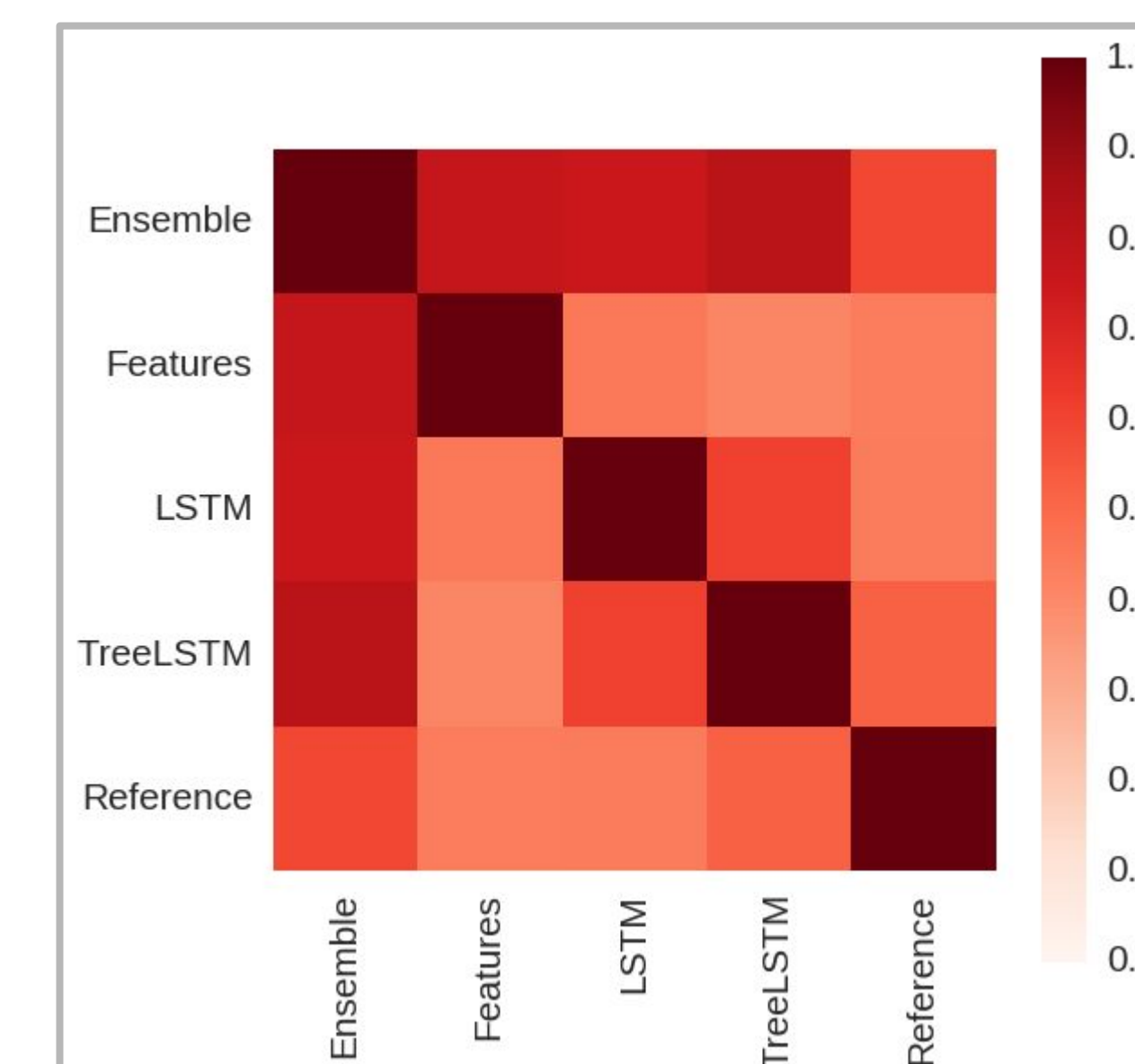
- [There's not a lot you can do about that](#)
- [There's not that much that you can do with a sourdough starter.](#)

Gold Standard	Feature-based	LSTM	TreeLSTM	Ensemble
2.0	3.96	0.31	1.39	<b>1.76</b>

- Distribution of gold similarity scores in the training data



- Base systems have pairwise low correlation: they capture **different views** of the data
- Correlation with ensemble system for all base systems is high (>0.7)



System	Ensemble	Features	LSTM	TreeLSTM	Reference
Ensemble	1	0.769	0.751	0.802	0.592
Feature-based	0.769	1	0.456	0.413	0.44
LSTM	0.751	0.456	1	0.608	0.442
TreeLSTM	0.802	0.413	0.608	1	0.523
Reference	0.592	0.44	0.442	0.523	1