### What is Entity Linking?

Entity Linking is a fundamental NLP task with many applications:
- Information extraction
- Automatic KB construction
- Enabling network navigation

### How is Entity Linking Performed?

- **Dictionaries/alias-tables for high-quality candidate generation**
- **Supervised learning via informative features**
  - Prior
  - Local/Global context
- **Sophisticated models on labelled data**
  - XGBoost
  - Deep neural networks

### Unaddressed Research Questions

- Absence of annotated/labelled training data
- Ability to operate at Web Scale

### Unsupervised Entity Linking with Eigenthemes

Eigenthemes are used for unsupervised entity linking:
- Fully unsupervised
- Light-weight and scalable
- Explainable
- Language agnostic

### Relationship between Eigenthemes and Gold Entities

![Relationship between Eigenthemes and Gold Entities](image)

### Results: CoNLL Dataset

<table>
<thead>
<tr>
<th>Category</th>
<th>Method</th>
<th>Prec@1 Easy</th>
<th>MRR Easy</th>
<th>Prec@1 Hard</th>
<th>MRR Hard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine</td>
<td>NameMatch (Radeel et al., 2010)</td>
<td>0.412</td>
<td>0.645</td>
<td>0.174</td>
<td>0.415</td>
</tr>
<tr>
<td>Examine</td>
<td>rMIL-ND (Le &amp; Tian, 2019)</td>
<td>0.451 ± 0.019</td>
<td>0.700 ± 0.052</td>
<td>0.187 ± 0.006</td>
<td>0.539 ± 0.017</td>
</tr>
<tr>
<td>Proposed</td>
<td>LOCAL CTXT</td>
<td>0.296</td>
<td>0.420</td>
<td>0.223</td>
<td>0.401</td>
</tr>
<tr>
<td>Proposed</td>
<td>GLOBAL CTXT</td>
<td>0.303</td>
<td>0.403</td>
<td>0.289</td>
<td>0.423</td>
</tr>
<tr>
<td>Proposed</td>
<td>DEGREE</td>
<td>0.571</td>
<td>1.0</td>
<td>0.0</td>
<td>0.649</td>
</tr>
<tr>
<td>Proposed</td>
<td>AVG</td>
<td>0.481</td>
<td>0.658</td>
<td>0.445</td>
<td>0.592</td>
</tr>
<tr>
<td>Proposed</td>
<td>W-MIL-ND</td>
<td>0.499 ± 0.022</td>
<td>0.778 ± 0.037</td>
<td>0.217 ± 0.008</td>
<td>0.992 ± 0.018</td>
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<tr>
<td>Proposed</td>
<td>EIGEN</td>
<td>0.671</td>
<td>0.858</td>
<td>0.506</td>
<td>0.696</td>
</tr>
</tbody>
</table>

1. Indicates statistical significance (p < 0.01) between the best and the second-best method using the Student’s paired t-test.

### Hyperparameter Tuning & Analysis

![Hyperparameter Tuning & Analysis](image)

### Summary

- **Efficacy**
  - NameMatch, Avg
  - MIL-ND, Degree
- **Robustness**
  - Local/Global context
- **Scalability**
  - Deepwalk, Word2vec

- Candidate generator using dictionaries
- Features (e.g., prior probability)
- Aligned entity and mention embeddings
- Training supervised models