Learning Fine-Grained Semantics for Multi-Relational Data  
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### Motivation
- Polysemous relations between different types of entities in knowledge graphs
- Relations with multiple semantics - exhibit distinct meanings in different contexts

### Evaluation
- Clustering algorithms - Spectral (SP), Optics (OP) and Hierarchical Agglomerative (HA)
- $C_{opt}$ clusters by SemSplit perform better than baselines, promising results

### Yago relations with different meanings

<table>
<thead>
<tr>
<th>Relation (algorithm)</th>
<th>SemSplit optimal clusters $C_{opt}$</th>
<th>Homegeneity Score (# clusters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>created (OP)</td>
<td>${\text{artist, medium}}$, ${\text{artist, movie}}$, ${\text{player, movie}}$, ${\text{company, computer_game}}$</td>
<td>0.14 (1) $C_{orig}$ 0.29 (9) $C_{max}(L)$ 0.49 (5) $C_{opt}(N)$</td>
</tr>
<tr>
<td>owns (SP)</td>
<td>${\text{company, airport}}$, ${\text{sovereign, building}}$, ${\text{company, club}}$</td>
<td>0.03 (1) $C_{orig}$ 0.32 (6) $C_{max}(L)$ 0.52 (3) $C_{opt}(N)$</td>
</tr>
<tr>
<td>isAffiliatedTo (HA)</td>
<td>${\text{artist, club}}$, ${\text{cricketer, club}}$, ${\text{player, club}}$ ${\text{hockey_player, club}}$, ${\text{officeholder, club}}$</td>
<td>0.09 (1) $C_{orig}$ 0.43 (7) $C_{max}(L)$ 0.61 (4) $C_{opt}(N)$</td>
</tr>
</tbody>
</table>

$C_{orig}$ - original relation cluster  
$C_{max}$ - maximal splitting clusters

### Method
- **SemSplit** - Define fine-grained relation semantics, data-driven, scalable method
- Leverage knowledge graph embeddings for semantic vectors
- Find optimal sub-relation clusters with well defined meanings

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