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AIDA-light: High-Throughput Named-Entity Disambiguation

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Overview

- Named Entity Disambiguation
- High-performance Accurate Entity Disambiguation
  - Simplifying Expensive Features
  - Categories and Domains
  - Multi-phase Computation
- Experiments

Named Entity Disambiguation (NED)

NED aims to map mentions of ambiguous names in natural language onto a set of known entities (e.g. YAGO or DBpedia).

Text & Mentions

Under Fergie, United won the Premier League title 13 times.

correct entities

Fergie_(singer), an American singer, songwriter, fashion designer, television host and actress.
Alex_Ferguson, a former Scottish football manager of Manchester United F.C.
Sarah, Duchess_of_York, the former wife of Prince Andrew, Duke of York.
. . .

United_Airlines, an American major airline.
United_Airways, a Bangladeshi airline.
Manchester_United_F.C., an English professional football club.
. . .

Premier League, the English professional football league.
. . .

State-of-the-art NED Systems

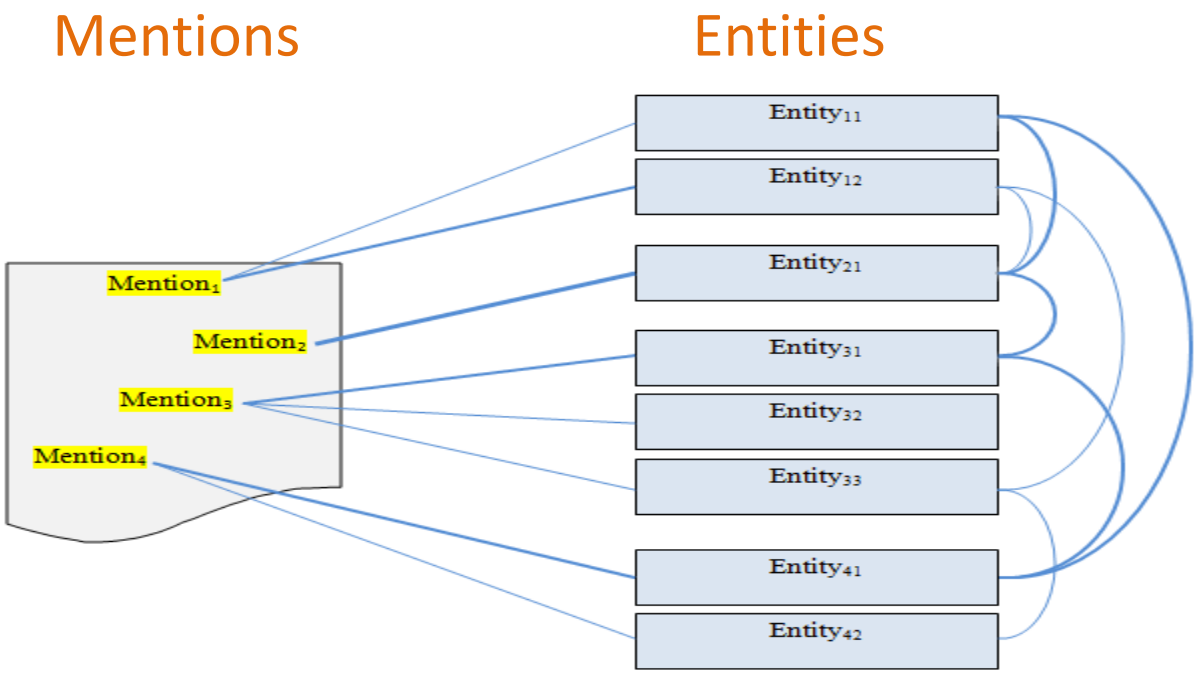
- Accurate Systems:
  - **AIDA** and **Illinois Wikifier:** use rich contextual features (and joint inference) → emphasis on quality.
- High-performance Systems:
  - **DBpedia Spotlight** and **TagMe:** mention-by-mention inference with more lightweight features → emphasis on speed.

AIDA-light

- **Goal**: reconcile efficiency and accuracy.
- **Approach**:
  - simplify expensive features.
  - add novel features with low footprint.
  - multi-phase computation.

Joint Inference over Disambiguation Graph

- Construct an undirected weighted graph between mentions and entities.
- Compute the best joint mapping sub-graph.



Simplify Expensive Features

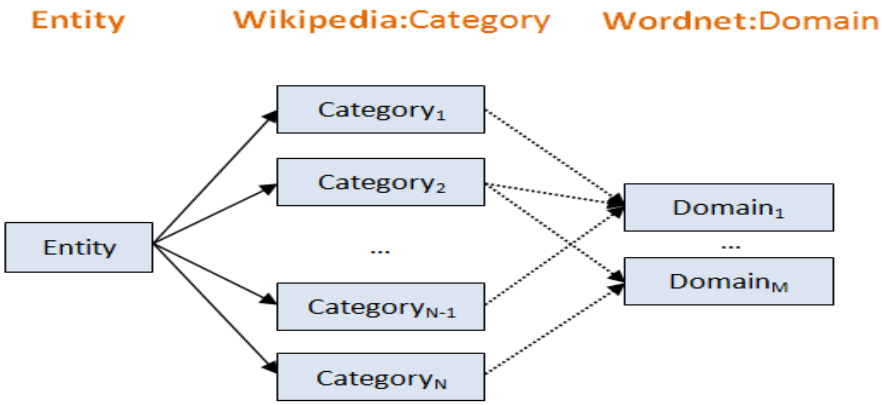
- **Key-phrases (AIDA):** link anchor texts including categories, citation titles, and external references.
- **Key-tokens**: extracted from all key-phrases except stop words.
- **Example**:
  - AIDA key-phrases: "*U.S. President*", "*President of the U.S.*"
  - AIDA-light key-tokens: "*President*", "*U.S.*"

Categories and Domains

- Entity, Categories and Domains
  - For example:

    Entity:Premier_League
    → Category:Football_Leagues
    →…→ Domain:Football

Domain Hierarchy



- Domain-Entity Coherence

  A entity belongs to a domain if it belongs to at least one category of the domain → recompute the mention-entity edge's weight under the domain.

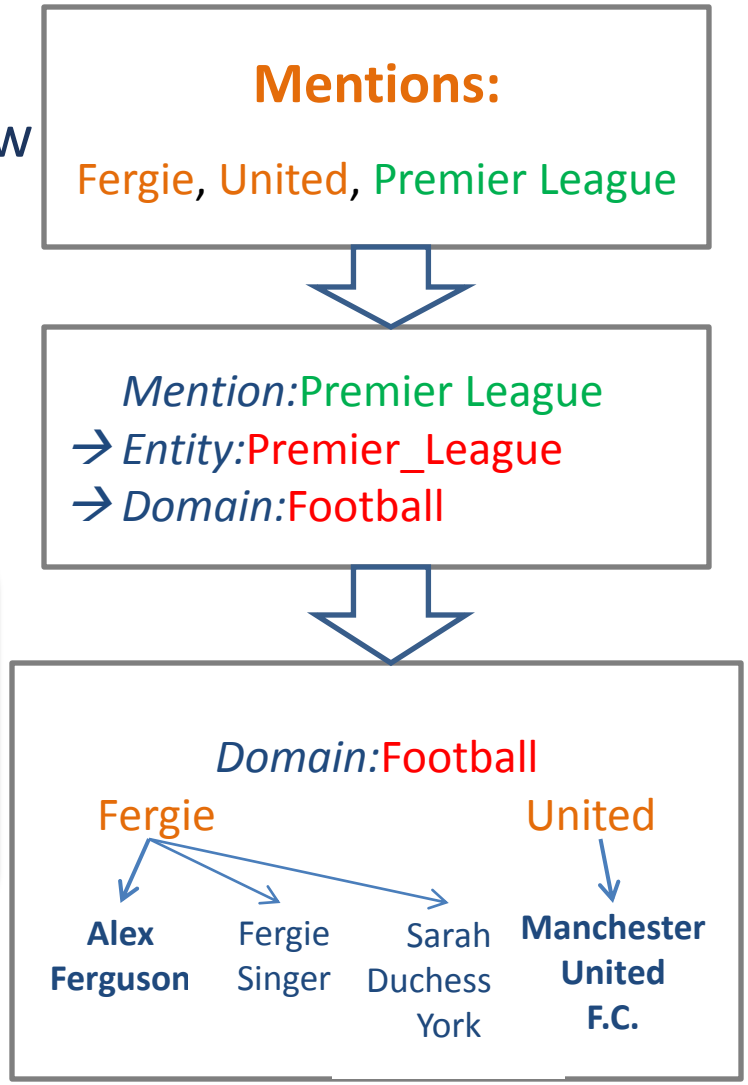
- Entity-Entity Coherence

  connect entities from the same domain → give higher weight to same-domain entity-entity coherence edges.

Multi-phase Computation

- **"Easy" mentions:** mentions with very few candidates or with skewed distributions.
- Update the context by chosen entities (with domains).

- Better understanding of the context.
- Reduce the complexity of the later stages.



Experimental Setup

- **Systems under comparison:**
  - AIDA-light
  - AIDA
  - DBpedia Spotlight
- **Performance measures:**
  - All systems take the same mentions as the input.
  - Each mention is mapped to one entity in **DBpedia** $\cap$ **YAGO**.
  - Mapping a mention of in-KB entity to null is a failure .

We apply per-mention precision.

Experimental Corpora

- **CoNLL-YAGO testb:** news articles with long-tail entities.
- **WP:** short contexts with highly ambiguous mentions and long-tail entities.
- **Wikipedia articles**: Wikipedia articles with internal links as mentions.
- **Wiki-links**: long documents with a few mentions.

Results on NED Quality

- Precision on different corpora, statistically significant improvements over Spotlight are marked with an asterisk.

Dataset	AIDA	AIDA-*light*	Spotlight
CoNLL-YAGO	82.5%*	**84.8%***	75.0%
WP	**84.7%***	84.4%*	63.8%
Wikipedia articles	**90.0%**	88.3%	89.6%
Wiki-links	80.3%	**85.1%***	80.7%

Results on Run-time

- Average per-document run-time results.

Dataset	AIDA-*light*	Spotlight
CoNLL-YAGO	0.47s	0.51s
WP	0.05s	0.14s
Wikipedia articles	5.47s	4.22s
Wiki-links	0.18s	0.32s

- **AIDA** uses a SQL database, not considered here.

Conclusion

- A high-performance accurate NED system
  - First method to consider domain coherence.
  - Judicious choice of high benefit/cost features.
- Experiments: AIDA-light
  - as good as rich-feature systems.
  - as efficient as fastest systems.

AIDA-light source code is available to download at
https://www.mpi-inf.mpg.de/yago-naga/aida/

Thanks!