MELT
Matching Evaluation Toolkit

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Joint Work

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Agenda

• Motivation
• What is MELT?
• Usage Example
• Q&A
MOTIVATION
Ontology Alignment Evaluation Initiative (OAEI)

Ontology Alignment Evaluation Initiative
- running campaigns since 2005
- structured in tracks (similar to task sets)
- researchers submit their implementation
  - centrally evaluated by track organizers
  - results published
Tooling

Semantic Evaluation at Large Scale
• (among others) packaging and evaluation
• OAEI support since 2010

Holistic Benchmarking of Big Linked Data
• (among others) packaging and evaluation
• OAEI support since 2017
• OAEI 2018: 6/19 matchers support HOBBIT
Pain Points

• **Limited evaluation capabilities** in SEALS, HOBBIT, and the Alignment API
• No easy-to-use **parameter tuning**
• **Packaging process might be complicated** for new entrants to the community
• Tooling **Java-focused** (no **Python**)
• Implementation of the Alignment API **not maven-based**
• **Tool breaks**
What is MELT?
What is MELT?

• Easy matcher development
• Non-Java matcher development
• Maven support

• Facilitate matcher packaging
• Facilitate matcher submission

• Allow for parameter optimization

• Streamlined development process
• Integration with existing tooling
• OAEI support
• Extensibility

• Advanced evaluation capabilities
• Evaluation before packaging
• Allow for interactive visualization
What is MELT?

Matcher Development

Matcher Fine-Tuning

Matcher Submission

Matcher Evaluation
What is MELT?

Matcher Development
Matcher Fine-Tuning
Matcher Submission
Matcher Evaluation
Yet Another Alignment API (YAAA)

MATCHER YAAA
+match(source:URL, target:URL, inputAlignment:Mapping):Mapping

MATCHER JENA

MATCHER OWL-API
Full SEALS/HOBBIT Support

MOTIVATION | WHAT IS MELT? | USAGE EXAMPLE
External Matching

- Simple wrapping
- Packageable for HOBBIT and SEALS
- Matcher can still be evaluated in MELT
- Documentation and demo project available on GitHub
What is MELT?

Matcher Development

Matcher Fine-Tuning

Matcher Submission

Matcher Evaluation
Parameter Tuning

• Run matcher configurations in **parallel** (i.e., multi-threaded)
• Hand over **ExecutionResultSet** to **Evaluator** and pick best value according to what you want to optimize
• **Out-of-the-box classes** that assist you
What is MELT?

Matcher Development
Matcher Fine-Tuning
Matcher Submission
Matcher Evaluation
Track track = TrackRepository.Multifarm.getSpecificMultifarmTrack("ar", "cn");

ExecutionResultSet ers = new ExecutionResultSet();

ers.addAll(Executor.run(track.getTestCases(), new Matcher(), "Matcher"));

EvaluatorCSV evaluatorCSV = new EvaluatorCSV(ers);

evaluatorCSV.write();
**Evaluation**

**Full OAEI support**: All tracks available (one-time automated download)

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evaluatorCSV.write();
```

Multiple evaluators available, extensible.
Exemplary Evaluation

“Show me the false positive class-class mappings for Multifarm on track en-de for matcher WiktionaryMatcher.”

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Exemplary Evaluation

“Show me the false positive class-class mappings for Multifarm on track en-de for matcher WiktionaryMatcher.” → Just filter the correspondences!

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<th>A</th>
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<th>D</th>
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<th>F</th>
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MOTIVATION | WHAT IS MELT? | USAGE EXAMPLE
More Evaluation

Filter for Scores or Correspondences

• **Micro Average Precision** and **Macro Average Precision** over track *Conference*

• All **residual true positives** for track *Anatomy*

• **Macro Average Class-F$_1$** for all tracks

• ...
What is MELT?

Matcher Development

Matcher Fine-Tuning

Matcher Submission

Matcher Evaluation
Matcher Submission

MATCHER SUBMISSION

MOTIVATION | WHAT IS MELT? | USAGE EXAMPLE

WHAT IS MELT?

FAIL MELT

(pom.xml)

(fill out a template – no maven wizardry required)

> mvn install
> mvn deploy

• Creates SEALS zip file → can be submitted right away
• Creates HOBBIT docker container
• Uploads and deploys container directly in HOBBIT automatically
Usage Example
Motivation

“Which matchers are interesting candidates for combination?”
→ Matchers with a high $F_1$ score and high “diversity”.
Quantitative Analysis I

Analysis OAEI 2018 results for Conference and Anatomy: Jaccard overlap of Alignments rendered as heatmap in LaTeX.

\[
J(a_1, a_2) = \frac{|corr(a_1) \cap corr(a_2)|}{|corr(a_1) \cup corr(a_2)|}
\]

Executor.loadFromAnatomyResultsFolder("myPath");
// few lines of other code (available on GitHub as // example)
### Table 1. OAEI Anatomy 2018 Alignment Similarity

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<th>ALIN</th>
<th>ALOD2Vec</th>
<th>AML</th>
<th>DOME</th>
<th>FCAMapX</th>
<th>Holontology</th>
<th>KEPLER</th>
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Mean Absolute Deviation (MAD) of Similarities plotted against $F_1$.

$$MAD = \frac{1}{n} \sum_{i=1}^{n} |x_i - \text{mean}(X)|$$
Results for Anatomy

Fig. 2. Matcher comparison using MAD and $F_1$ on the Anatomy data set
Results for Anatomy

Fig. 2. Matcher comparison using MAD and $F_1$ on the Anatomy data set.
Fig. 3. Matcher comparison using MAD and $F_1$ on the Conference data set.
There is MUCH more to MELT

Ontology **Caching** Services

Multi-Threaded Matcher Execution

Baseline **Matchers**

Execution of SEALS packages from within MELT

**OAEI-Track Organizer Tools**

ExecutionResult Indexing

**Automatic Reading** of OAEI Result Alignments

One-Time **Auto-Download** of OAEI Tracks

Matcher **Pipelining**
Thank you!

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