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How to Compare Methods for Automated Keyword Extraction

Setting Up an Evaluation Plan for Method Selection

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Three complementary approaches for improving automated keyword extraction

- Find and write better algorithms for keyword extraction
- Reduce the complexity of the problem
- **Get better at diagnosing good keyword extraction**

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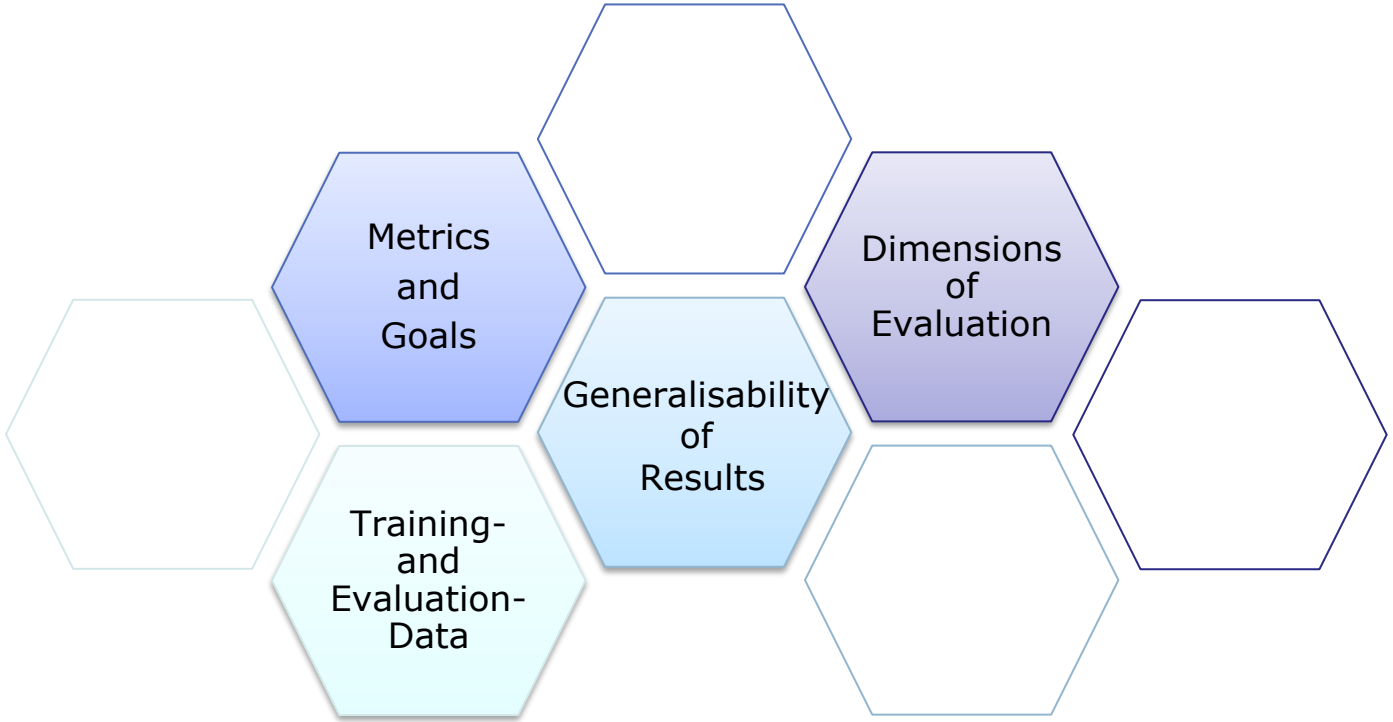
Aspects of Evaluation in ML-Projects



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Generalisability of Evaluation Results

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Generalisability of Results

In every measurement one has to account for **systematic** error and **random** error

Examples of systematic error:

- Distribution shift between production and training[1]
- Information leakage between training and evaluation data

Examples of random error:

- Random splitting of data into training and evaluation data
- ”Unknowns” in a complex data generation process

[1]cf. Toepfer M, Seifert C 2020; Fusion architectures for automatic subject indexing under concept drift; https://doi.org/10.1007/s00799-018-0240-3

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Generalisability of Results

- while systematic error can only be assessed on a case-by-case basis, random error can be quantified with **confidence intervals**
- Random error is influenced by the **size of the test-set** as well as underlying **variability of the data**

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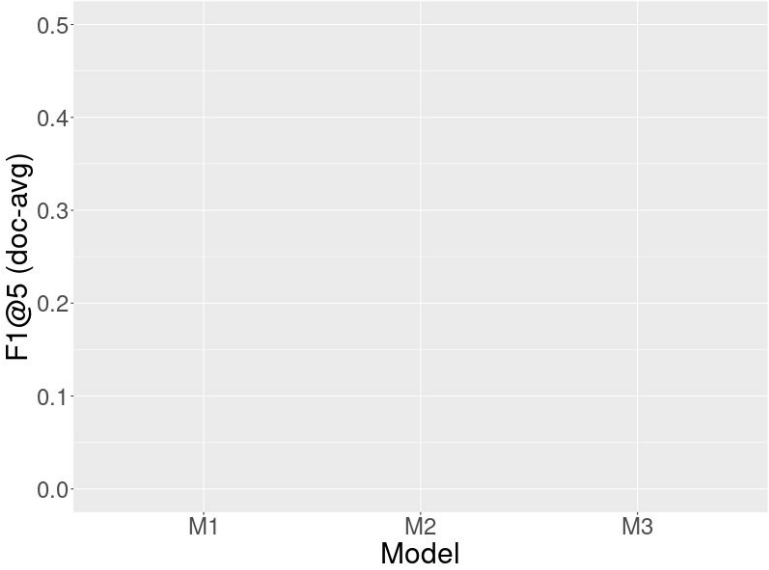
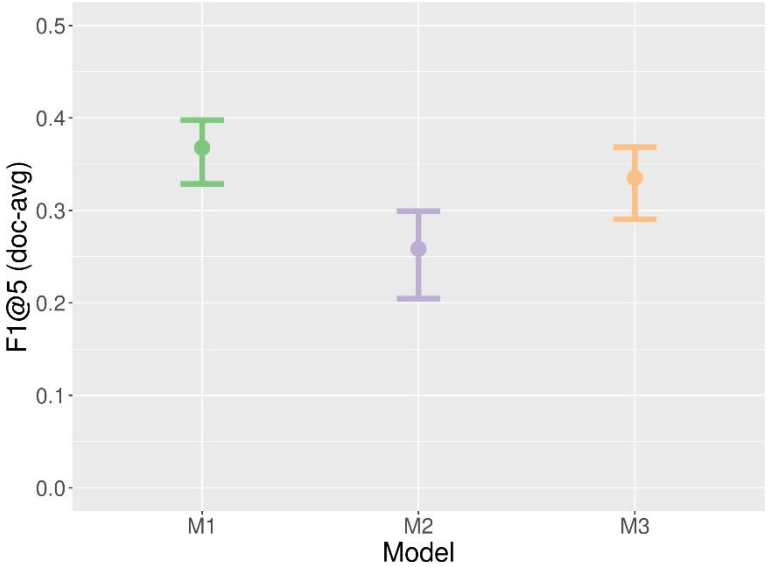
Example: boot-strap confidence intervals to quantify uncertainty

Repeated calculations of the target metric under resampling of test-set result in a range of different results



Percentiles of the resampled results form a confidence interval that helps to assess the uncertainty due to random error



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Dimensions of Evaluation

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Dimensions of Evaluation

- Overall performance metrics produce no insights into why and how good/ bad indexing performance is achieved
- A useful evaluation workflow must enable „drill-down" analytics to generate hypothesis to improve indexing algorithms
- Important **Dimensions of Evaluation** should be agreed upon between subject specialists and data scientists

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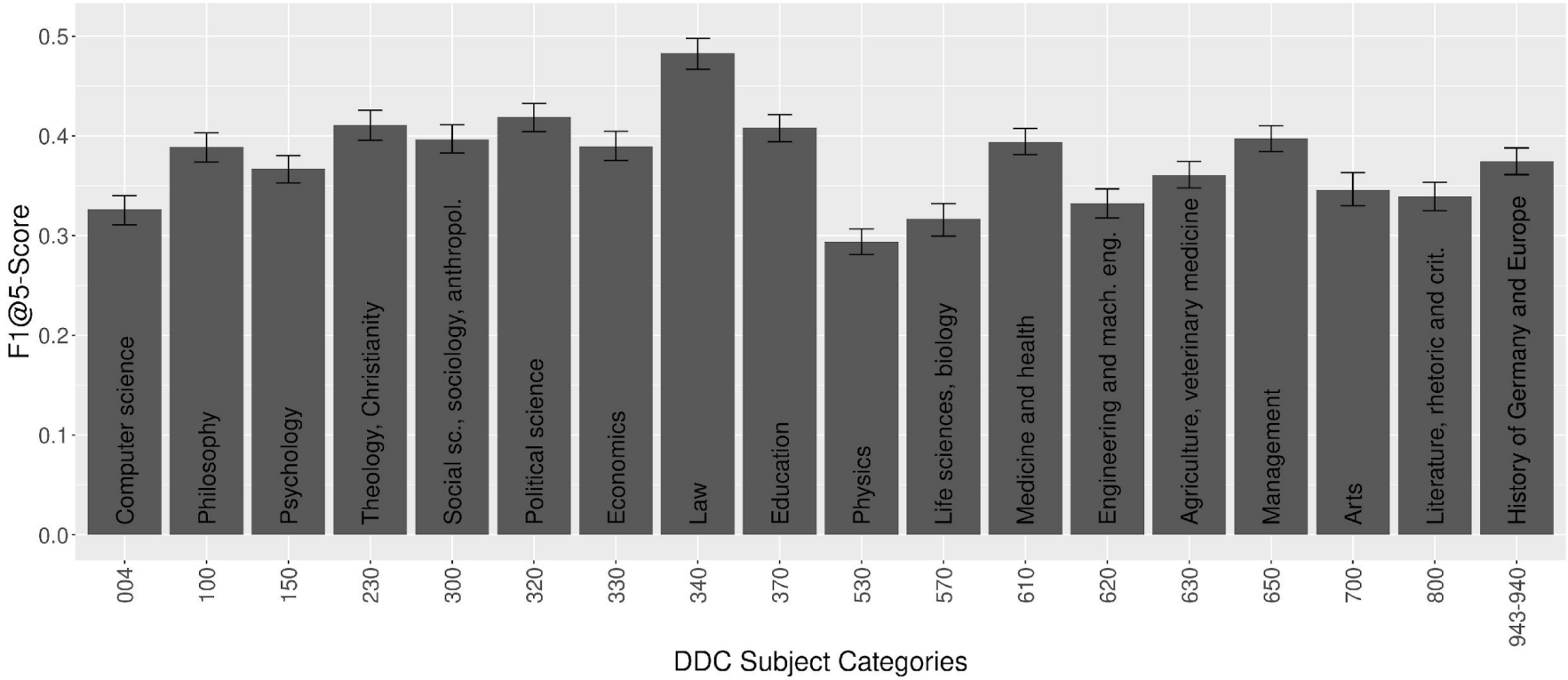
Example: Indexing performance stratified by subjects categories



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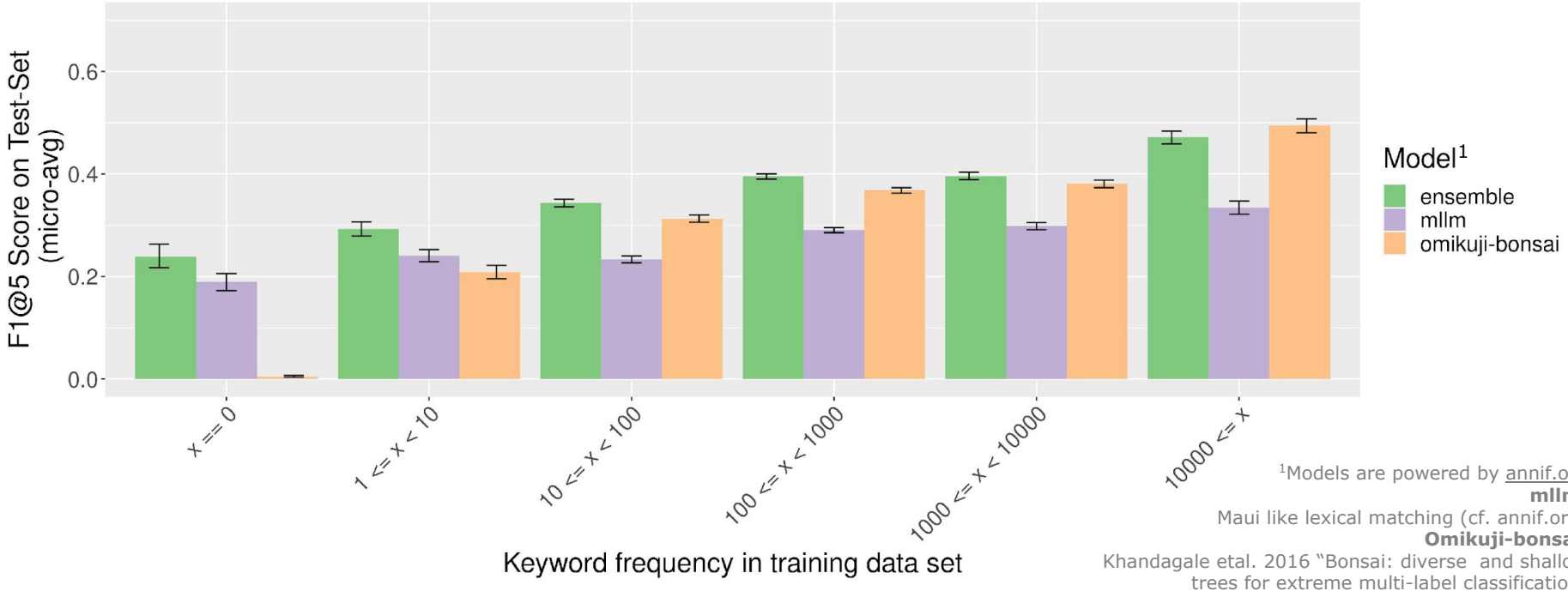
Example: Indexing performance stratified by keyword frequency for different models



[1]Models are powered by annif.org

mllm:
Maui like lexical matching (cf. annif.org)

Omikuji-bonsai:
Khandagale etal. 2016 "Bonsai: diverse and shallow trees for extreme multi-label classification"

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Dimensions of Evaluation impact Test-Set construction and size

- Dimensions of Evaluation need to be considered before splitting your data into training and evaluation data
- The overall size of your test set is determined by the error rate and confidence level you require for your metric-estimates in the smallest stratum of your evaluation
- stratified sampling techniques can ensure that all strata of evaluation are present in your test-set

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Summary: Where do we meet?

- Plan your evaluation scheme, before you start training models
- Discuss the dimensions of your data that need to be looked at
- Choose metrics that reflect your goals and priorities
- Discuss uncertainty and generalizability of your results

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Thank you!

Please get in touch for further questions and discussion:

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