# Evaluation

Or: how to take a Llama‘s measurements

Speaker: Simeon Harrison
Trainer at EuroCC Austria

EURO AUSTRIA

# Measuring up

## Huggingface evaluate library: https://huggingface.co/docs/evaluate/

Different types of evaluation, depending on
- Goals
- Datasets
- Models

Huggingface currently offers/supports
- Metrics
- Comparisons
- Measurements

# Metrics

## Generic

Metrics that can be applied to many different tasks and datasets.

- accuracy, precision, recall
- F1 score
- Perplexity

## Task specific

Tasks such as Machine Translation or Summarisation have specific metrics.

- BLEU
- ROGUE

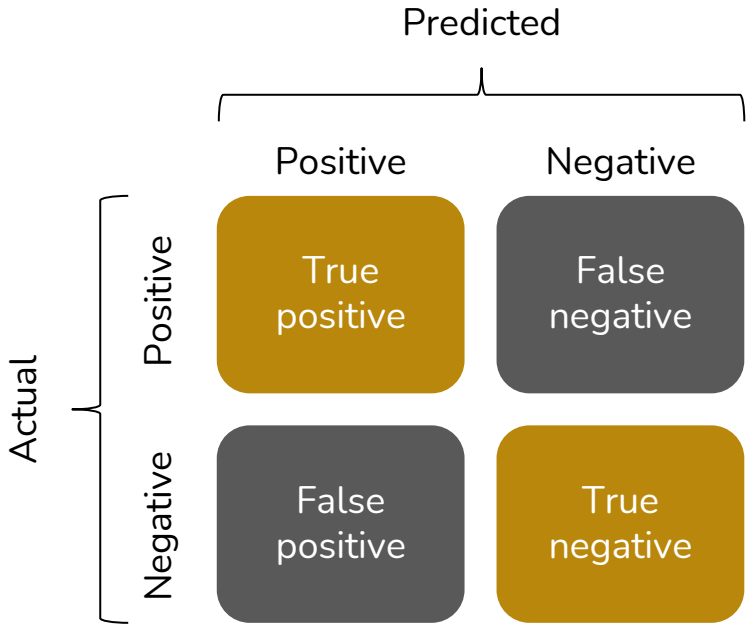
## Dataset specific

Datasets, which are used as benchmarks use specific metrics.

- GLUE
- SQuAD

# Generic

## Confusion Matrix



# Generic

## Accuracy

$$accuracy = \frac{TP + TN}{TP + FP + TN + FN}$$

## Precision

$$precision = \frac{TP}{TP + FP}$$

## Recall

$$recall = \frac{TP}{TP + FN}$$

## F1 score

$$F_1 = 2 \times \frac{precision \times recall}{precision + recall}$$

# Generic

## Perplexity

Measures how well a model predicts a sequence of tokens

Lower values indicate more confident and accurate predictions. A perplexity of 1 means perfect certainty.

To measure the perplexity of a certain model the test dataset needs to be a dataset the model has been trained on, since the metric should quantize how well the model “learned” a given text.

Perplexity can only be calculated for casual language models.

# Task specific

## BLEU

Algorithm for evaluating the quality of **machine-translated text**.

Quality is considered to be the correspondence between a machine's output and that of a human:

"The closer a machine translation is to a professional human translation, the better it is"

Source: Huggingface website

# Task specific

## ROUGE

ROUGE, or Recall-Oriented Understudy for Gisting Evaluation, is a set of metrics used for evaluating **summarizations performed by LLMs**

The metrics compare a generated summary or translation against a reference human-produced summary.

# Dataset specific

## GLUE

The **GLUE (General Language Understanding Evaluation)** benchmark is a collection of tasks designed to evaluate and benchmark natural language understanding models across a variety of language tasks.

Rather than a single metric, GLUE includes multiple tasks, each with its own evaluation metrics. These tasks help assess different aspects of language understanding, such as sentiment analysis, natural language inference, and linguistic acceptability.

# Dataset specific

## SQuAD

The **SQuAD (Stanford Question Answering Dataset) metric** is specifically designed to evaluate **Question Answering (QA)** systems, particularly for tasks where a model answers questions based on a given context or passage.

The primary metrics used in the SQuAD dataset are:

- Exact Match
- F1 Score

# Comparisons

Useful to compare the performance metrics of several models on a given test dataset.

Comparisons are not used a lot yet.

Example: McNemar Test
Paired, nonparametric statistical hypothesis test. Compares predictions of two models and measures their divergence.

# Measurements

Used to gain more insight on datasets and model predicitons.

Datasets: average word length and distribution

Models: number off attention blocks, hidden dimension etc.

# THANK YOU

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