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[`paraphrase_mining()`](../../../docs/package_reference/util.html#sentence_transformers.util.paraphr

ase_mining)

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[`semantic_search()`](../../../docs/package_reference/util.html#sentence_transformers.util.semantic_search)

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[`truncate_embeddings()`](../../../docs/package_reference/util.html#sentence_transformers.util.truncate_embeddings)

* [Model Optimization](../../../docs/package_reference/util.html#module-sentence_transformers.backend)

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[`export_dynamic_quantized_onnx_model()`](../../../docs/package_reference/util.html#sentence_transformers.backend.export_dynamic_quantized_onnx_model)

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[`export_optimized_onnx_model()`](../../../docs/package_reference/util.html#sentence_transformers.backend.export_optimized_onnx_model)

*

[`export_static_quantized_openvino_model()`](../../../docs/package_reference/util.html#sentence_transformers.backend.export_static_quantized_openvino_model)

* [Similarity Metrics](../../../docs/package_reference/util.html#module-sentence_transformers.util)

* [`cos_sim()`](../../../docs/package_reference/util.html#sentence_transformers.util.cos_sim)

* [`dot_score()`](../../../docs/package_reference/util.html#sentence_transformers.util.dot_score)

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[`euclidean_sim()`](../../../docs/package_reference/util.html#sentence_transformers.util.euclidean_sim)

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[`manhattan_sim()`](../../../docs/package_reference/util.html#sentence_transformers.util.manhattan_sim)

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[`pairwise_cos_sim()`](../../../docs/package_reference/util.html#sentence_transformers.util.pairwise_cos_sim)

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[`pairwise_dot_score()`](../../../docs/package_reference/util.html#sentence_transformers.util.pairwise_dot_score)

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[`pairwise_euclidean_sim()`](../../../docs/package_reference/util.html#sentence_transformers.util.pairwise_euclidean_sim)

*

[`pairwise_manhattan_sim()`](../../../docs/package_reference/util.html#sentence_transformers.util.pairwise_manhattan_sim)

__[Sentence Transformers](../../../index.html)

  * [](../../../index.html)
  * Cross-Encoders

* [Edit on GitHub](https://github.com/UKPLab/sentence-transformers/blob/master/examples/applications/cross-encoder/README.md)

* * *

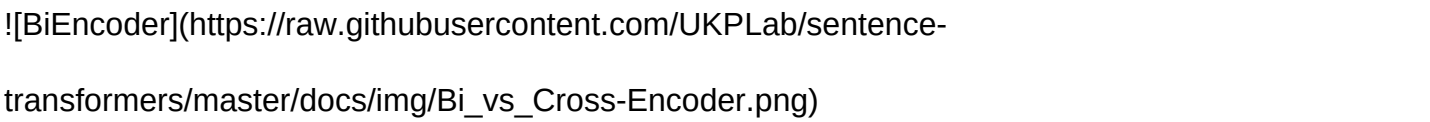
Cross-Encodersïƒ•

SentenceTransformers also supports to load Cross-Encoders for sentence pair scoring and sentence pair classification tasks.

Bi-Encoder vs. Cross-Encoderï•

First, it is important to understand the difference between Bi- and Cross-Encoder.

Bi-Encoders produce for a given sentence a sentence embedding. We pass to a BERT independently the sentences A and B, which result in the sentence embeddings u and v. These sentence embedding can then be compared using cosine similarity:



In contrast, for a **Cross-Encoder** , we pass both sentences simultaneously to the Transformer network. It produces then an output value between 0 and 1 indicating the similarity of the input sentence pair:

A **Cross-Encoder does not produce a sentence embedding**. Also, we are not able to pass individual sentences to a Cross-Encoder.

As detailed in our [paper](https://arxiv.org/abs/1908.10084), Cross-Encoder achieve better performances than Bi-Encoders. However, for many application they are not practical as they do not produce embeddings we could e.g. index or efficiently compare using cosine similarity.

When to use Cross- / Bi-Encoders?ï•

Cross-Encoders can be used whenever you have a pre-defined set of sentence pairs you want to score. For example, you have 100 sentence pairs and you want to get similarity scores for these 100 pairs.

Bi-Encoders (see [Computing Sentence Embeddings](../computing-embeddings/README.html)) are used whenever you need a sentence embedding in a vector space for efficient comparison. Applications are for example Information Retrieval / Semantic Search or Clustering. Cross-Encoders would be the wrong choice for these application: Clustering 10,000 sentence with CrossEncoders would require computing similarity scores for about 50 Million sentence combinations, which takes about 65 hours. With a Bi-Encoder, you compute the embedding for each sentence, which takes only 5 seconds. You can then perform the clustering.

Cross-Encoders Usageïƒ•

Using Cross-Encoders is quite easy:

```
from sentence_transformers.cross_encoder import CrossEncoder

model = CrossEncoder("model_name_or_path")
scores = model.predict([["My first", "sentence pair"], ["Second text", "pair"]])
```

You pass to `model.predict` a list of sentence **pairs**. Note, Cross-Encoder do not work on individual sentence, you have to pass sentence pairs.

As model name, you can pass any model or path that is compatible with Hugging Face [AutoModel](https://huggingface.co/transformers/model_doc/auto.html) class

For a full example, to score a query with all possible sentences in a corpus see [cross-encoder_usage.py](https://github.com/UKPLab/sentence-transformers/tree/master/examples/applications/cross-encoder/cross-encoder_usage.py).

Combining Bi- and Cross-Encodersïƒ•

Cross-Encoder achieve higher performance than Bi-Encoders, however, they do not scale well for large datasets. Here, it can make sense to combine Cross- and Bi-Encoders, for example in Information Retrieval / Semantic Search scenarios: First, you use an efficient Bi-Encoder to retrieve e.g. the top-100 most similar sentences for a query. Then, you use a Cross-Encoder to re-rank these 100 hits by computing the score for every (query, hit) combination.

For more details on combing Bi- and Cross-Encoders, see [Application - Information Retrieval](../retrieve_rerank/README.html).

Training Cross-Encodersïƒ•

See [Cross-Encoder Training](../../training/cross-encoder/README.html) how to

train your own Cross-Encoder models.

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