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* * *

Augmented SBERTïƒ•

Motivationïƒ•

Bi-encoders (a.k.a. sentence embeddings models) require substantial training data and fine-tuning over the target task to achieve competitive performances. However, in many scenarios, there is only little training data available.

To solve this practical issue, we release an effective data-augmentation strategy known as **Augmented SBERT** where we utilize a high performing and slow cross-encoder (BERT) to label a larger set of input pairs to augment the training data for the bi-encoder (SBERT).

For more details, refer to our publication - [Augmented SBERT: Data Augmentation Method for Improving Bi-Encoders for Pairwise Sentence Scoring Tasks](https://arxiv.org/abs/2010.08240) which is a joint effort by Nandan Thakur, Nils Reimers and Johannes Daxenberger of UKP Lab, TU Darmstadt.

Chien Vu also wrote a nice blog article on this technique: [Advance BERT model via transferring knowledge from Cross-Encoders to Bi-Encoders](https://towardsdatascience.com/advance-nlp-model-via-transferring-knowledge-from-cross-encoders-to-bi-encoders-3e0fc564f554)

Extend to your own datasetsïƒ•

Scenario 1: Limited or small annotated datasets (few labeled sentence-pairs (1k-3k))

If you have specialized datasets in your company or research which are small-sized or contain labeled few sentence-pairs. You can extend the idea of Augmented SBERT (in-domain) strategy by training a cross-encoder over your small gold dataset and use BM25 sampling to generate combinations not seen earlier. Use the cross-encoder to label these unlabeled pairs to create the silver dataset. Finally train a bi-encoder (i.e. SBERT) over your extended dataset (gold+silver) dataset as shown in [train_sts_indomain_bm25.py](https://github.com/UKPLab/sentence-transformers/tree/master/examples/training/data_augmentation/train_sts_indomain_bm25.py).

Scenario 2: No annotated datasets (Only unlabeled sentence-pairs)

If you have specialized datasets in your company or research which only contain unlabeled sentence-pairs. You can extend the idea of Augmented SBERT (domain-transfer) strategy by training a cross-encoder over a source dataset which is annotated (for eg. QQP). Use this cross-encoder to label your specialised unlabeled dataset i.e. target dataset. Finally train a bi-encoder i.e. SBERT over your labeled target dataset as shown in [train_sts_qqp_crossdomain.py](https://github.com/UKPLab/sentence-transformers/tree/master/examples/training/data_augmentation/train_sts_qqp_crossdomain.py).

Methodologyïƒ•

There are two major scenarios for the Augmented SBERT approach for pairwise-sentence regression or classification tasks.

Scenario 1: Limited or small annotated datasets (few labeled sentence-pairs)ïƒ•

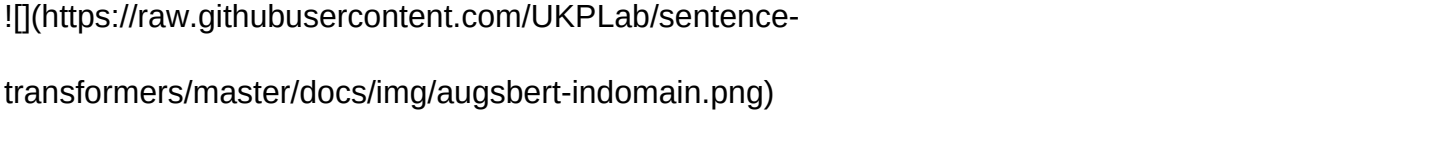
We apply the Augmented SBERT (**In-domain**) strategy, it involves three steps -

* Step 1: Train a cross-encoder (BERT) over the small (gold or annotated) dataset

* Step 2.1: Create pairs by recombination and reduce the pairs via BM25 or semantic search

* Step 2.2: Weakly label new pairs with cross-encoder (BERT). These are silver pairs or (silver) dataset

* Step 3: Finally, train a bi-encoder (SBERT) on the extended (gold + silver) training dataset



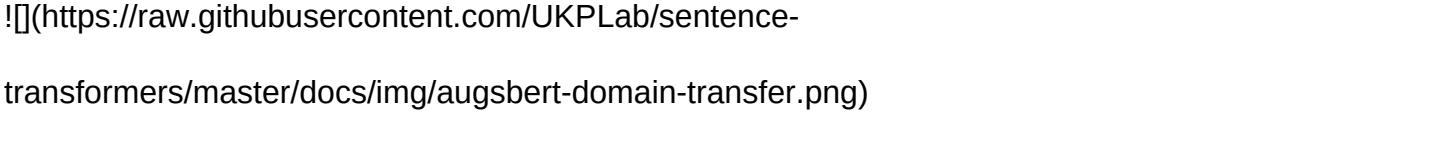
Scenario 2: No annotated datasets (Only unlabeled sentence-pairs)ïƒ•

We apply the Augmented SBERT (**Domain-Transfer**) strategy, it involves three steps -

* Step 1: Train from scratch a cross-encoder (BERT) over a source dataset, for which we contain annotations

* Step 2: Use this cross-encoder (BERT) to label your target dataset i.e. unlabeled sentence pairs

* Step 3: Finally, train a bi-encoder (SBERT) on the labeled target dataset



Trainingïƒ•

The [examples/training/data_augmentation](https://github.com/UKPLab/sentence-transformers/blob/master/examples/training/data_augmentation/) folder contains simple training examples for each scenario explained below:

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[train_sts_seed_optimization.py](https://github.com/UKPLab/sentence-transformers/tree/master/examples/training/data_augmentation/train_sts_seed_optimization.py)

* This script trains a bi-encoder (SBERT) model from scratch for STS benchmark dataset with seed-optimization.

* Seed optimization technique is inspired from [(Dodge et al., 2020)](https://arxiv.org/abs/2002.06305).

* For Seed opt., we train our bi-encoder for various seeds and evaluate using an early stopping algorithm.

* Finally, measure dev performance across the seeds to get the highest performing seeds.

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[train_sts_indomain_nlpaug.py](https://github.com/UKPLab/sentence-transformers/tree/master/examples/training/data_augmentation/train_sts_indomain_nlpaug.py)

* This script trains a bi-encoder (SBERT) model from scratch for STS benchmark dataset using easy data augmentation.

* Data augmentation strategies are used from popular [nlpaug](https://github.com/makcedward/nlpaug) package.

* Augment single sentences with synonyms using (word2vec, BERT or WordNet). Forms our silver dataset.

* Train bi-encoder model on both original small training dataset and synonym based silver dataset.

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[train_sts_indomain_bm25.py](https://github.com/UKPLab/sentence-transformers/tree/master/examples/training/data_augmentation/train_sts_indomain_bm25.py)

* Script initially trains a cross-encoder (BERT) model from scratch for small STS benchmark dataset.

* Recombine sentences from our small training dataset and form lots of sentence-pairs.

* Limit number of combinations with BM25 sampling using [Elasticsearch](https://www.elastic.co/).

* Retrieve top-k sentences given a sentence and label these pairs using the cross-encoder (silver dataset).

* Train a bi-encoder (SBERT) model on both gold + silver STSb dataset. (Augmented SBERT (In-domain) Strategy).

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[train_sts_indomain_semantic.py](https://github.com/UKPLab/sentence-transformers/tree/master/examples/training/data_augmentation/train_sts_indomain_semantic.py)

* This script initially trains a cross-encoder (BERT) model from scratch for small STS benchmark dataset.

* We recombine sentences from our small training dataset and form lots of sentence-pairs.

* Limit number of combinations with Semantic Search sampling using pretrained SBERT model.

* Retrieve top-k sentences given a sentence and label these pairs using the cross-encoder (silver dataset).

* Train a bi-encoder (SBERT) model on both gold + silver STSb dataset. (Augmented SBERT (In-domain) Strategy).

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[train_sts_qqp_crossdomain.py](https://github.com/UKPLab/sentence-transformers/tree/master/examples/training/data_augmentation/train_sts_qqp_crossdomain.py)

* This script initially trains a cross-encoder (BERT) model from scratch for STS benchmark dataset.

* Label the Quora Questions Pair (QQP) training dataset (Assume no labels present) using the cross-encoder.

* Train a bi-encoder (SBERT) model on the QQP dataset. (Augmented SBERT (Domain-Transfer) Strategy).

Citationïƒ•

If you use the code for augmented sbert, feel free to cite our publication
[Augmented SBERT: Data Augmentation Method for Improving Bi-Encoders for
Pairwise Sentence Scoring Tasks](https://arxiv.org/abs/2010.08240):

```
@article{thakur-2020-AugSBERT,
    title = "Augmented SBERT: Data Augmentation Method for Improving Bi-Encoders for Pairwise Sentence Scoring Tasks",
    author = "Thakur, Nandan and Reimers, Nils and Daxenberger, Johannes and Gurevych, Iryna",
    journal= "arXiv preprint arXiv:2010.08240",
    month = "10",
    year = "2020",
    url = "https://arxiv.org/abs/2010.08240",
}
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[Previous](../distillation/README.html "Model Distillation") [Next

](../prompts/README.html "Training with Prompts")

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