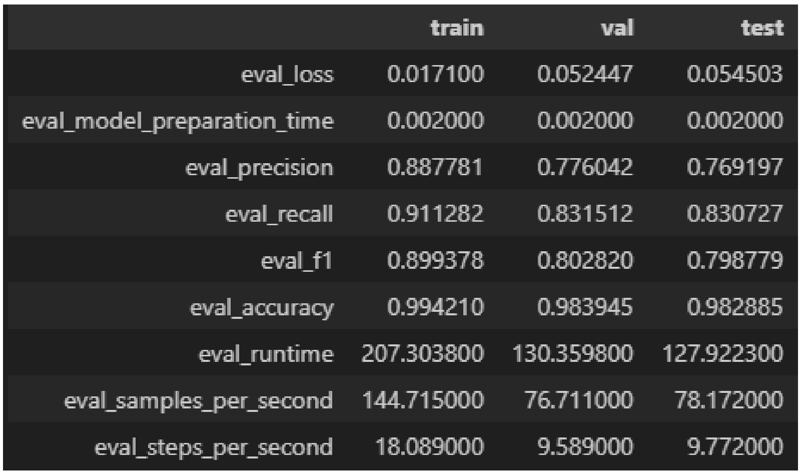
### Task 1. Natural Language Processing. Named entity recognition

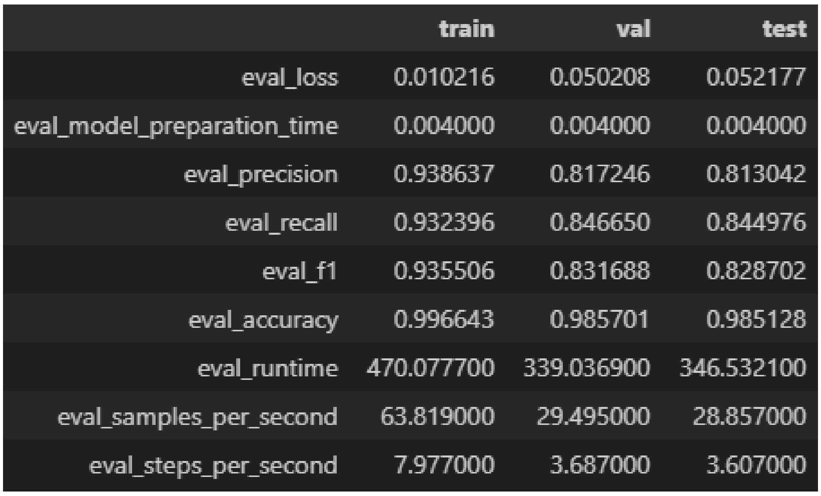
This task was solved using Hugging Face’s models and datasets. More specifically it uses BERT models (dslim/bert-base-NER and dslim/bert-large-NER) for fine-tuning on on the NER dataset with mountain names (Gepe55o/mountain-ner-dataset).

After 3 epochs of training, I got these results:



| | train | val | test |
|---:|---:|---:|---:|
| eval_loss | 0.017100 | 0.052447 | 0.054503 |
| eval_model_preparation_time | 0.002000 | 0.002000 | 0.002000 |
| eval_precision | 0.887781 | 0.776042 | 0.769197 |
| eval_recall | 0.911282 | 0.831512 | 0.830727 |
| eval_f1 | 0.899378 | 0.802820 | 0.798779 |
| eval_accuracy | 0.994210 | 0.983945 | 0.982885 |
| eval_runtime | 207.303800 | 130.359800 | 127.922300 |
| eval_samples_per_second | 144.715000 | 76.711000 | 78.172000 |
| eval_steps_per_second | 18.089000 | 9.589000 | 9.772000 |

For the base model, and these results:



| | train | val | test |
|---:|---:|---:|---:|
| eval_loss | 0.010216 | 0.050208 | 0.052177 |
| eval_model_preparation_time | 0.004000 | 0.004000 | 0.004000 |
| eval_precision | 0.938637 | 0.817246 | 0.813042 |
| eval_recall | 0.932396 | 0.846650 | 0.844976 |
| eval_f1 | 0.935506 | 0.831688 | 0.828702 |
| eval_accuracy | 0.996643 | 0.985701 | 0.985128 |
| eval_runtime | 470.077700 | 339.036900 | 346.532100 |
| eval_samples_per_second | 63.819000 | 29.495000 | 28.857000 |
| eval_steps_per_second | 7.977000 | 3.687000 | 3.607000 |

For the large model.

Results are better on the large model, but it also works about 2 times slower.

***What could be done to improve the results***:

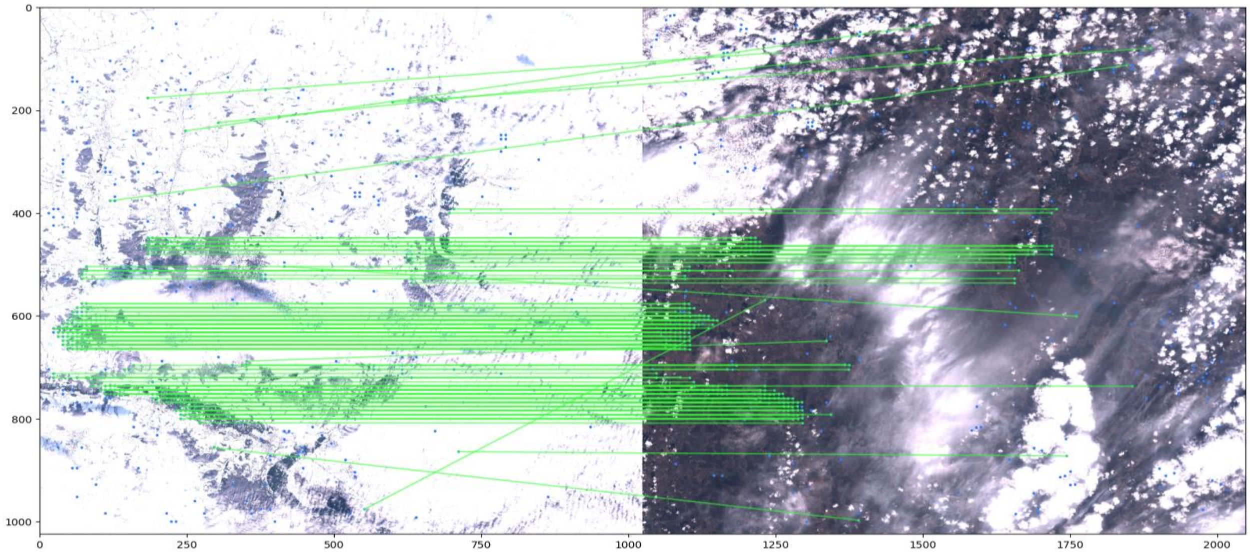
- Trying other models\libraries.

- Trying different hyperparameters (at least the number of epochs and learning rate).
- As far as I know, Hugging Face's Trainer trains all the weights of the model, but considering that we use different classification head, it should be better to firstly train only it with higher learning rate and then unfreeze all the weights and train further with lower learning rate.
- Trying other datasets or adding data to the used one. Perhaps adding\reducing the number of mountain tokens in the dataset could lead to an improvement. Also it is worth checking whether the dataset contains all possible mountain names.

### Task 2. Computer vision. Sentinel-2 image matching

This task was solved using SIFT from opencv, DISK+SuperGlue and LoFTR from kornia and images from the following dataset: https://www.kaggle.com/datasets/isaienkov/deforestation-in-ukraine. I could rate models\algorithms from the worst to the best like this: SIFT -> DISK+SuperGlue -> LoFTR.

LoFTR uses more computer resources than the other two, but still quite fast and gives good results even with difficult images. For example:



Despite finding some incorrect points, it still found good matches. The other two algorithms found zero matches here.

***What could be done to improve the results***:

- Trying different scaling methods and augmentations (different parameters of clahe, brightness or contrast changes, etc.).
- Changing parameters of algorithms or image sizes.
- Trying another models\algorithms.
- Training or fine-tuning deep learning models (but from what I've seen, it's challenging because there are no user-friendly interfaces for this, and you need to prepare a dataset for it).