## **Experiment Multilingual NER**

#### 1. Dataset

This experiment for Sequence Labeling for dataset of 5 languages: Arabic, Finnish, Portuguese, Thai, Vietnamese.

 $\textbf{Link dataset:}\ https://drive.google.com/drive/folders/1y6sxZaSLm1viOfSsV04ZgfilfiwGMB13?usp=sharing$ 

Information dataset (Each Language): Dataset for Multilingual NER

# 2. Multilingual Named Entity Recognition Using Pretrained Embeddings, Attention Mechanism and NCRF

**\*** Result for changing Embedded Layer:

	Presision	Recall	F1-score	Size
bert-base-multilingual-cased  ✓ Result Detail  precision recall f1-score support  B-ORG 0.80173565 0.79138113 0.79652474 7588 B-PER 0.91301951 0.89025046 0.90149124 9303 B-LOC 0.83118950 0.84897738 0.83998928 7383 B-MISC 0.83523840 0.88255705 0.85824600 14986 I-ORG 0.81456875 0.80492380 0.80971755 8530 I-PER 0.94201508 0.90124590 0.92117962 7625 I-LOC 0.87368626 0.81751958 0.84467024 5491 I-MISC 0.85180517 0.78815395 0.81874432 12004  micro avg 0.85485217 0.84308051 0.84882037 72910 macro avg 0.85790729 0.84062616 0.84882037 72910 eighted avg 0.85563794 0.84308051 0.84886977 72910	0.855	0.843	0.849	722 MB
roberta-base  **Result Detail*    precision   recall   f1-score   support	0.819	0.773	0.795	500 MB
xlm-roberta-base  → Result Detail  precision recall f1-score support  B-ORG 0.81519481 0.82570376 0.82041563 7602  B-PER 0.93301173 0.91299217 0.92289340 9321  B-LOC 0.84735244 0.86657664 0.85685672 7405  B-MISC 0.84791403 0.89147338 0.86914828 15047  I-ORG 0.83287133 0.84368784 0.83824470 8547  I-PER 0.94669142 0.93430179 0.94045580 7641  I-LOC 0.86705625 0.86123708 0.86413686 5513  I-MISC 0.86358266 0.78854772 0.82436125 12050  micro avg 0.86728310 0.86450784 0.86589325 73126  macro avg 0.86920933 0.86556505 0.86706408 73126  weighted avg 0.86789094 0.86450784 0.86576904 73126	0.867	0.864	0.865	1.1 GB

# **3. XtremeDistil: Multi-stage Distillation for Massive Multilingual Models**

## **Result model Teacher**

Model Teacher	Presisi on	Recall	F1- score	Accura cy (have O)	Accurac y (non- O)	Size	Time process per batch
Teacher-tf  (checkpoint: bert-base-multilingual-cased)  **Result Detail  The parameter 'return dict' cannot be set in graph mode and will always be set to 'True'. processer 47738 tokens with 18088 phrases; found: 18644 phrases; correct: 1808. eccuracy: 55.88; precision: 78.39; recell: 77.294; Fel: 76.21 3193  MISE precision: 80.69; recell: 77.394; Fel: 76.21 3193  MISE precision: 80.699; recell: 66.719; Fel: 66.69 3214  THF0:xtremedisili:Tist scores 78.33453496755588 77.29428583675598 77.31893339699213	0.7833	0.7729	0.7781	0.9588	0.8245	711.7 MB	
Teacher-pth  (checkpoint: jplu/tf-xlm-r-ner-40-lang)  **Result Detail  Stort to itest process.  proceeded 99918 tokens with 99926 phrases; found: 21318 phrases; correct: 16999. accuracy: 85.54%; foun-0] accuracy: 85.54%; foun-0] accuracy: 95.54%; foun-0] accuracy: 95.54%; foun-0] accuracy: 96.54%; precision: 79.76%; recall: 77.36%; f81: 76.96 3772  MISC: precision: 76.56%; recall: 77.36%; f81: 76.96 3772  ORG: precision: 72.46%; recall: 72.54%; f81: 72.26 4165  PRO:xtremedistil:fest scores 79.69790787128248 81.13086304119277 80.43745857399868	0.79698	0.81191	0.80437	0.9625	0.8554	1.1 GB	0.0125 s
Teacher-pth  (checkpoint: bert-base-multilingual-cased)  *Result Detail  Start to test process.  processed 977131 tokens with 16808 phrases; found: 16446 phrases; correct: 13187.  accuracy: 99.14%; precision: 80.18%; recall: 78.9%; F81: 79.17  loc: precision: 78.10%; recall: 78.9%; F81: 78.9% 1322  MISC: precision: 67.20%; recall: 79.9%; F81: 88.9% 2323  ORG: precision: 67.70%; recall: 69.22%; F81: 88.46 2295  PRINTO:xtremedistilitent scores 80.18303127812233 78.17761441783129 79.1679173920874	0.802	0.782	0.79168	0.9614	0.8299	711.5 MB	0.0123 s

## Result model Student

Model Teacher	Model Student	Presisi on	Recall	F1- score	Accura cy (have O)	Accura cy (non- O)	Size	Speed up
jplu/tf-xlm-r- ner-40-lang	microsoft/xtremedistil-16-h256-uncased  * Result Detail    Total to State   Total to	0.7561	0.798	0.7765	0.9563	0.8496	281.4 MB	x 2 (0.0064 s)

	microsoft/xtremedistil-16-h384-uncased  * Result Detail	0.76969	0.794223	0.781768	0.9573	0.8419	436,3 MB	x 2 (0.0067 s)
	microsoft/xtremedistil-112-h384-uncased  * Result Detail	0.7793	0.7938	0.7865	0.9589	0.8402	486,1 MB	x 1 (0.0129 s)
bert-base- multilingual- cased	microsoft/xtremedistil-16-h256-uncased  * Result Detail  The to be press, faced, 1989 please; cerect; 1270.  **Soft To be to b	0.7489	0.7585	0.75369	0.9542	0.8179	147.8 MB	x 1 (0.0065 s)
	microsoft/xtremedistil-16-h384-uncased  * Result Detail	0.7356	0.7699	0.7524	0.9521	0.8296	236 MB	x 2 (0.0068 s)
	microsoft/xtremedistil-112-h384-uncased  * Result Detail  International Control of the Control o	0.7656	0.76197	0.7638	0.9548	0.8186	285.7 MB	x 1 (0.0128 s)

#### **\*** Conlusion:

- Mô hình hc cô ng trên có th cho ra kt qu tt gn bng vi mô hình teacher (gim khong 1.5- 4% F1- score)
- S dng mô hình pretrain cho student kích the càng nh thì size càng nh và te chy s nhanh lên so vi mô hình teacher.
- Kích the ca mô hình có th gim t 3-4 ln. Trong khi ó te cho mô hình student ch s dng 6 layer là Bertlayer thì chy nhanh gp 2 ln so vi mô hình teacher nhng vi 12 lp Bertlayer (ging vi teacher model me dù chiu ngang ã thu nh bt) thì te ci thin ko áng k.