

Cross-Lingual Transfer of Large Context

Efficient models in low-resource Languages



Introduction



Introduction

- Transformers for NLP
- 7000+ Languages
- 20 pre-trained Different Languages BERT
- Open-problems:
 - Lack of Available Data
 - High- vs. Low-Resource Languages
 - Inference and Short Retention



Research Questions

1. Large Context in Low-Resource Languages?
2. Can Long Context be Transferred?
3. How to Design such Datasets for Evaluation?
4. Performance Effects?
 - a. Other Languages
 - b. Other Context Lengths



Outline

1. Background
 2. Method
 3. Results
 4. Conclusion & Future Works
-



01 / Background

Transformer Models and Attention



What are the issues?

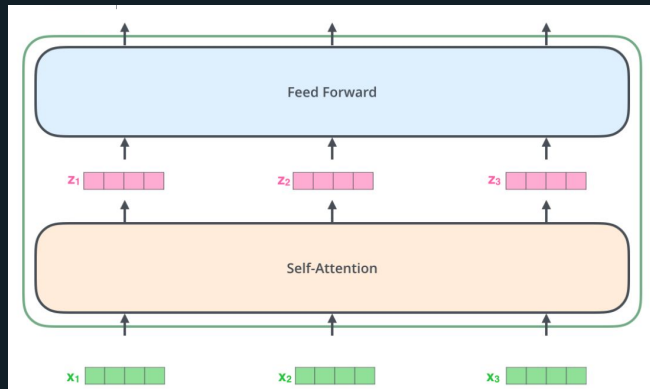
Some of the biggest open problems in NLP

- Short Attention-Window / Retention -
Leads to poor retention
- Lack of Support for Low-Resource
Languages - Looking at Bert lang, most
are for high-resource langs
- Poor Language Understanding /
Inference

Training a Transformer Model

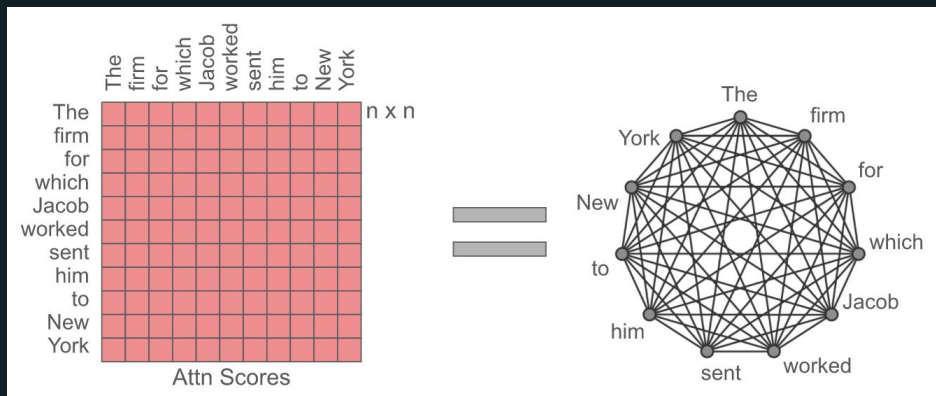
- Transformers - Encoder/Decoder blocks
- **Ideal:** Train on annotated data
- **However:** Annotations = Expensive
 - Pre-train a general Language Model
 - Fine-tune on Downstream Task - QA

Encoder Block



The Attention Mechanism

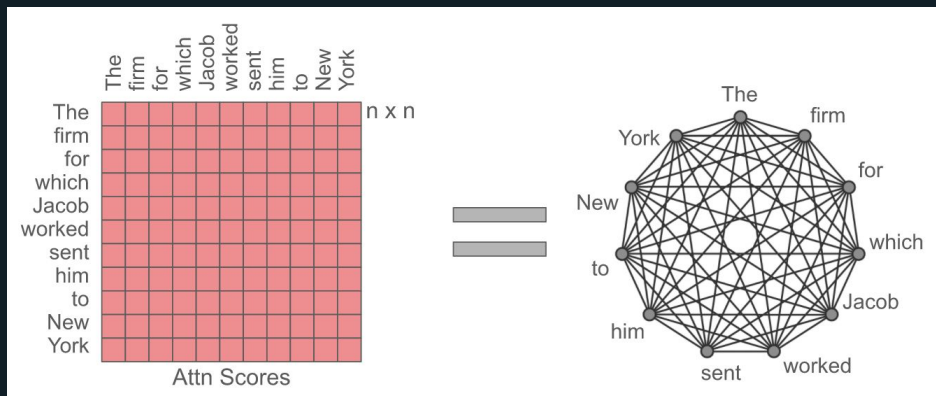
- Similarity measure
- Learn relations between words
- An all-to-all comparison
- Learn different representations





Problem with Attention

- Expensive!
- Restricted Attention Window
- Shorter Retention





What are the issues?

Open Problems in NLP:

- Short Attention-Window / Retention -
Leads to poor retention
- Lack of Support for Low-Resource
Languages - Looking at Bert lang, most
are for high-resource langs
- Poor Language Understanding /
Inference

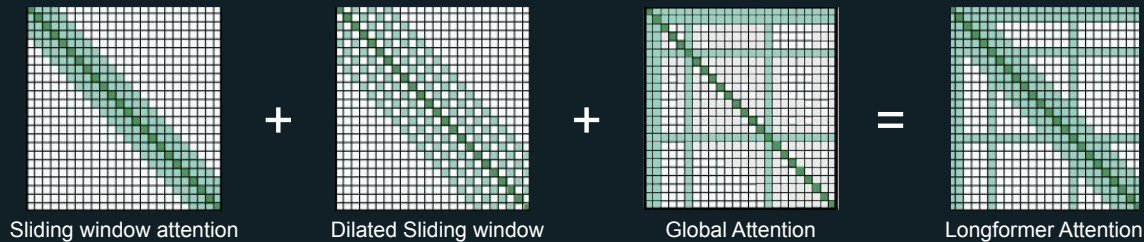


The Longformer



Longformer

RoBERTa-base max length: **512 tokens**
Longformer length: **4,096 tokens** (x8 RoBERTa)
Longformer max length: **32,256 tokens** (x16 RoBERTa)





Tasks for Evaluation

Requirements:

- Language Understanding
- Long-Context Reasoning
- Data Available in Multiple Languages



Question and Answering

SQuAD Formated Datasets



SQuAD Like Datasets

Context 1

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

Q1

To whom did the Virgin Mary allegedly appear in 1858 in Lourdes France?

A1

```
{
  "answer_start": [
    515
  ],
  "text": [
    "Saint Bernadette"
  ]
}
```




SQuAD Like Datasets

Context 1

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

Q1

To whom did the Virgin Mary allegedly appear in 1858 in Lourdes France?

A1

```
{
  "answer_start": [
    515
  ],
  "text": [
    "Saint Bernadette"
  ]
}
```



SQuAD Like Datasets

Context 1

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

Q1

To whom did the Virgin Mary allegedly appear in 1858 in Lourdes France?

A1

```
{
  "answer_start": [
    515
  ],
  "text": [
    "Saint Bernadette"
  ]
}
```



SQuAD Like Datasets

Context 1

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

Q1

To whom did the Virgin Mary allegedly appear in 1858 in Lourdes France?

A1

```
{
  "answer_start": [
    515
  ],
  "text": [
    "Saint Bernadette"
  ]
}
```



Long Context QA Datasets

- Multi-Sentence Reasoning
- Inference and Reading Comprehension

Big Oak Tree State Park is a state - owned nature preserve ... in the Mississippi Alluvial Plain portion of the **Gulf Coastal Plain**.

The **Gulf Coastal Plain** extends around the Gulf of Mexico in the **Southern United States**...

The **Southern United States**, commonly referred to as the American South, Dixie, or simply the South, is a region of the **United States of America**.

Q: (**Big Oak Tree State Park**, located in, ?)
A: **United States of America**



SQ3 - Long-Context

Context 1

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the

Context 2

golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive

Context 3

Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

New Long Context

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.



SQ3 - Long-Context

Context 1

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the

Context 2

golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive

Context 3

Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

New Long Context

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

SQ3 (512)



SQ3 - Long-Context

Context 1

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the

Context 2

golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive

Context 3

Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

New Long Context

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

SQ3 (4096)



02 / Method



Method

Pre-Train + Fine-Tune

1. Pre-train Long Context:

- English & Multilingual
- Wikitext 103

2. Fine-Tune for Question-Answering:

- SQuAD-formated
- Multiple Languages
- Longer Context Length
- 5 Different seeds



Method

Monolingual QA

Model	SQuAD	SQ3 (512)	SQ3 (4096)
RoBERTa	✓	✓	—
Longformer	✓	✓	✓
RoBERTa-Long	✓	✓	✓
XLM-R	✓	✓	—
XLM-Long	✓	✓	✓

Multilingual QA

Model	XQuAD	XQ3 (512)	XQ3 (4096)	MLQA
XLM-R	✓	✓	—	✓
XLM-Long	✓	✓	✓	✓



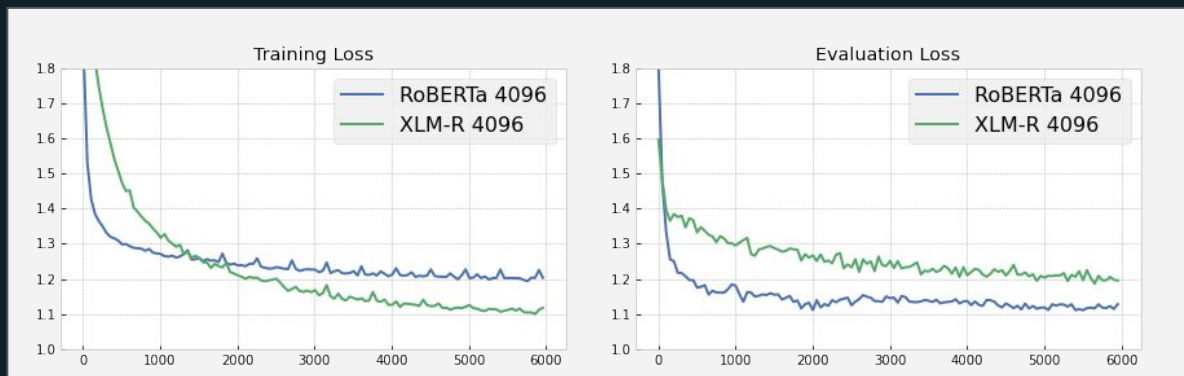
Results



Results

1. Pre-Training

- Same Perplexity and BPC as Longformer





Results

2. Fine-Tune

a. English

Model	Regular (512)		SQ3 (512)		SQ3 (4096)	
	EM	F1	EM	F1	EM	F1
RoBERTa	84.3 \pm 0.2	91.2 \pm 0.1	81.4 \pm 0.3	88.1 \pm 0.1	-	-
Longformer	85.1\pm0.2	91.4\pm0.2	84.8\pm0.2	91.0\pm0.3	84.3\pm0.2	90.8\pm0.2
RoBERTa-Long	83.8 \pm 0.2	90.8 \pm 0.1	78.7 \pm 0.2	83.4 \pm 0.1	76.8 \pm 0.1	81.8 \pm 0.2
XLM-R	81.9\pm0.3	88.7 \pm 0.1	76.3 \pm 0.3	83.0 \pm 0.1	-	-
XLM-Long	81.9 \pm 0.5	89.1\pm0.1	76.7\pm0.1	83.5\pm0.0	70.2\pm0.1	77.3\pm0.1



Results

2. Fine-Tune

a. English

Model	Regular (512)		SQ3 (512)		SQ3 (4096)	
	EM	F1	EM	F1	EM	F1
RoBERTa	84.3 \pm 0.2	91.2 \pm 0.1	81.4 \pm 0.3	88.1 \pm 0.1	-	-
Longformer	85.1\pm0.2	91.4\pm0.2	84.8\pm0.2	91.0\pm0.3	84.3\pm0.2	90.8\pm0.2
RoBERTa-Long	83.8 \pm 0.2	90.8 \pm 0.1	78.7 \pm 0.2	83.4 \pm 0.1	76.8 \pm 0.1	81.8 \pm 0.2
XLM-R	81.9\pm0.3	88.7 \pm 0.1	76.3 \pm 0.3	83.0 \pm 0.1	-	-
XLM-Long	81.9 \pm 0.5	89.1\pm0.1	76.7 \pm 0.1	83.5 \pm 0.0	70.2 \pm 0.1	77.3 \pm 0.1



Results

2. Fine-Tune

a. English

Model	Regular (512)		SQ3 (512)		SQ3 (4096)	
	EM	F1	EM	F1	EM	F1
RoBERTa	84.3 ± 0.2	91.2 ± 0.1	81.4 ± 0.3	88.1 ± 0.1	-	-
Longformer	85.1 ± 0.2	91.4 ± 0.2	84.8 ± 0.2	91.0 ± 0.3	84.3 ± 0.2	90.8 ± 0.2
RoBERTa-Long	83.8 ± 0.2	90.8 ± 0.1	78.7 ± 0.2	83.4 ± 0.1	76.8 ± 0.1	81.8 ± 0.2
XLM-R	81.9 ± 0.3	88.7 ± 0.1	76.3 ± 0.3	83.0 ± 0.1	-	-
XLM-Long	81.9 ± 0.5	89.1 ± 0.1	76.7 ± 0.1	83.5 ± 0.0	70.2 ± 0.1	77.3 ± 0.1



Results

2. Fine-Tune

a. English

Model	Regular (512)		SQ3 (512)		SQ3 (4096)	
	EM	F1	EM	F1	EM	F1
RoBERTa	84.3 \pm 0.2	91.2 \pm 0.1	81.4 \pm 0.3	88.1 \pm 0.1	-	-
Longformer	85.1 \pm 0.2	91.4 \pm 0.2	84.8 \pm 0.2	91.0 \pm 0.3	84.3 \pm 0.2	90.8 \pm 0.2
RoBERTa-Long	83.8 \pm 0.2	90.8 \pm 0.1	78.7 \pm 0.2	83.4 \pm 0.1	76.8 \pm 0.1	81.8 \pm 0.2
XLM-R	81.9 \pm 0.3	88.7 \pm 0.1	76.3 \pm 0.3	83.0 \pm 0.1	-	-
XLM-Long	81.9 \pm 0.5	89.1 \pm 0.1	76.7 \pm 0.1	83.5 \pm 0.0	70.2 \pm 0.1	77.3 \pm 0.1



Results

2. Fine-Tune

b. Multilingual

Language	Regular (512)		XQ3 (512)		XQ3 (4096)	
	XLM-R	XLM-Long	XLM-R	XLM-Long	XLM-R	XLM-Long
Arabic (AR)	65.2 ± 1.1	66.1 ± 0.9	62.4 ± 1.4	61.9 ± 0.4	-	51.3 ± 1.4
German (DE)	74.8 ± 0.5	74.7 ± 0.7	67.7 ± 1.1	66.9 ± 0.8	-	59.7 ± 1.0
Greek (EL)	72.5 ± 0.3	72.3 ± 0.3	58.6 ± 0.3	61.1 ± 0.5	-	48.9 ± 1.6
English (EN)	84.0 ± 0.6	83.8 ± 0.1	81.3 ± 0.3	81.6 ± 0.5	-	74.7 ± 1.3
Spanish (ES)	75.8 ± 0.4	75.6 ± 0.3	69.7 ± 0.1	71.1 ± 0.6	-	60.8 ± 1.5
Hindi (HI)	66.1 ± 0.7	67.0 ± 0.3	65.1 ± 1.1	65.2 ± 0.1	-	47.1 ± 1.5
Russian (RU)	73.6 ± 0.3	73.0 ± 0.4	68.7 ± 0.1	68.5 ± 0.6	-	59.7 ± 0.6
Taiwanese (TH)	60.6 ± 1.0	58.8 ± 0.8	49.7 ± 1.3	49.1 ± 1.1	-	33.5 ± 0.8
Turkish (TR)	66.1 ± 0.2	65.8 ± 0.6	66.6 ± 0.1	65.7 ± 0.6	-	55.5 ± 0.9
Vietnamese (VI)	73.6 ± 0.2	72.6 ± 0.2	67.6 ± 0.3	65.4 ± 0.0	-	54.3 ± 1.3
Chinese (ZH)	63.3 ± 0.5	62.9 ± 0.6	60.8 ± 1.0	62.2 ± 1.1	-	51.7 ± 2.7



Results

2. Fine-Tune

b. Multilingual

Language	Regular (512)		XQ3 (512)		XQ3 (4096)	
	XLM-R	XLM-Long	XLM-R	XLM-Long	XLM-R	XLM-Long
Arabic (AR)	65.2 ± 1.1	66.1 ± 0.9	62.4 ± 1.4	61.9 ± 0.4	-	51.3 ± 1.4
German (DE)	74.8 ± 0.5	74.7 ± 0.7	67.7 ± 1.1	66.9 ± 0.8	-	59.7 ± 1.0
Greek (EL)	72.5 ± 0.3	72.3 ± 0.3	58.6 ± 0.3	61.1 ± 0.5	-	48.9 ± 1.6
English (EN)	84.0 ± 0.6	83.8 ± 0.1	81.3 ± 0.3	81.6 ± 0.5	-	74.7 ± 1.3
Spanish (ES)	75.8 ± 0.4	75.6 ± 0.3	69.7 ± 0.1	71.1 ± 0.6	-	60.8 ± 1.5
Hindi (HI)	66.1 ± 0.7	67.0 ± 0.3	65.1 ± 1.1	65.2 ± 0.1	-	47.1 ± 1.5
Russian (RU)	73.6 ± 0.3	73.0 ± 0.4	68.7 ± 0.1	68.5 ± 0.6	-	59.7 ± 0.6
Taiwanese (TH)	60.6 ± 1.0	58.8 ± 0.8	49.7 ± 1.3	49.1 ± 1.1	-	33.5 ± 0.8
Turkish (TR)	66.1 ± 0.2	65.8 ± 0.6	66.6 ± 0.1	65.7 ± 0.6	-	55.5 ± 0.9
Vietnamese (VI)	73.6 ± 0.2	72.6 ± 0.2	67.6 ± 0.3	65.4 ± 0.0	-	54.3 ± 1.3
Chinese (ZH)	63.3 ± 0.5	62.9 ± 0.6	60.8 ± 1.0	62.2 ± 1.1	-	51.7 ± 2.7



Results

2. Fine-Tune

b. Multilingual

Language	Regular (512)		XQ3 (512)		XQ3 (4096)	
	XLm-R	XLm-Long	XLm-R	XLm-Long	XLm-R	XLm-Long
Arabic (AR)	65.2 ± 1.1	66.1 ± 0.9	62.4 ± 1.4	61.9 ± 0.4	-	51.3 ± 1.4
German (DE)	74.8 ± 0.5	74.7 ± 0.7	67.7 ± 1.1	66.9 ± 0.8	-	59.7 ± 1.0
Greek (EL)	72.5 ± 0.3	72.3 ± 0.3	58.6 ± 0.3	61.1 ± 0.5	-	48.9 ± 1.6
English (EN)	84.0 ± 0.6	83.8 ± 0.1	81.3 ± 0.3	81.6 ± 0.5	-	74.7 ± 1.3
Spanish (ES)	75.8 ± 0.4	75.6 ± 0.3	69.7 ± 0.1	71.1 ± 0.6	-	60.8 ± 1.5
Hindi (HI)	66.1 ± 0.7	67.0 ± 0.3	65.1 ± 1.1	65.2 ± 0.1	-	47.1 ± 1.5
Russian (RU)	73.6 ± 0.3	73.0 ± 0.4	68.7 ± 0.1	68.5 ± 0.6	-	59.7 ± 0.6
Taiwanese (TH)	60.6 ± 1.0	58.8 ± 0.8	49.7 ± 1.3	49.1 ± 1.1	-	33.5 ± 0.8
Turkish (TR)	66.1 ± 0.2	65.8 ± 0.6	66.6 ± 0.1	65.7 ± 0.6	-	55.5 ± 0.9
Vietnamese (VI)	73.6 ± 0.2	72.6 ± 0.2	67.6 ± 0.3	65.4 ± 0.0	-	54.3 ± 1.3
Chinese (ZH)	63.3 ± 0.5	62.9 ± 0.6	60.8 ± 1.0	62.2 ± 1.1	-	51.7 ± 2.7



Results

2. Fine-Tune

b. Multilingual

Language	Regular (512)		XQ3 (512)		XQ3 (4096)	
	XLM-R	XLM-Long	XLM-R	XLM-Long	XLM-R	XLM-Long
Arabic (AR)	65.2 ± 1.1	66.1 ± 0.9	62.4 ± 1.4	61.9 ± 0.4	-	51.3 ± 1.4
German (DE)	74.8 ± 0.5	74.7 ± 0.7	67.7 ± 1.1	66.9 ± 0.8	-	59.7 ± 1.0
Greek (EL)	72.5 ± 0.3	72.3 ± 0.3	58.6 ± 0.3	61.1 ± 0.5	-	48.9 ± 1.6
English (EN)	84.0 ± 0.6	83.8 ± 0.1	81.3 ± 0.3	81.6 ± 0.5	-	74.7 ± 1.3
Spanish (ES)	75.8 ± 0.4	75.6 ± 0.3	69.7 ± 0.1	71.1 ± 0.6	-	60.8 ± 1.5
Hindi (HI)	66.1 ± 0.7	67.0 ± 0.3	65.1 ± 1.1	65.2 ± 0.1	-	47.1 ± 1.5
Russian (RU)	73.6 ± 0.3	73.0 ± 0.4	68.7 ± 0.1	68.5 ± 0.6	-	59.7 ± 0.6
Taiwanese (TH)	60.6 ± 1.0	58.8 ± 0.8	49.7 ± 1.3	49.1 ± 1.1	-	33.5 ± 0.8
Turkish (TR)	66.1 ± 0.2	65.8 ± 0.6	66.6 ± 0.1	65.7 ± 0.6	-	55.5 ± 0.9
Vietnamese (VI)	73.6 ± 0.2	72.6 ± 0.2	67.6 ± 0.3	65.4 ± 0.0	-	54.3 ± 1.3
Chinese (ZH)	63.3 ± 0.5	62.9 ± 0.6	60.8 ± 1.0	62.2 ± 1.1	-	51.7 ± 2.7



Conclusion

And Future Works



Conclusion

- Longformer to Extend Attention Window
- Extend in One Language = Same performance
- Replicated Longformer Results
- Could **Not** Confirm Cross-Lingual context Transfer



Future Works

- Long-Context Datasets
- BigBird Model just Released
- Hyper-parameter Optimization
- Larger Multilingual Models
- Reformer Multilingual Training



Future Works

SQuAD

Architecturally, the school has a Catholic character. Atop the Main Building's gold dome is a golden statue of the Virgin Mary. Immediately in front of the Main Building and facing it, is a copper statue of Christ with arms upraised with the legend "Venite Ad Me Omnes". Next to the Main Building is the Basilica of the Sacred Heart. Immediately behind the basilica is the Grotto, a Marian place of prayer and reflection. It is a replica of the grotto at Lourdes, France where the Virgin Mary reputedly appeared to Saint Bernadette Soubirous in 1858. At the end of the main drive (and in a direct line that connects through 3 statues and the Gold Dome), is a simple, modern stone statue of Mary.

WikiHop

Big Oak Tree State Park is a state - owned nature preserve ... in the Mississippi Alluvial Plain portion of the **Gulf Coastal Plain**.

The **Gulf Coastal Plain** extends around the Gulf of Mexico in the **Southern United States**...

The **Southern United States**, commonly referred to as the American South, Dixie, or simply the South, is a region of the **United States of America**.

Q: (**Big Oak Tree State Park**, located in, ?)

A: **United States of America**



Future Works

- Long-Context Datasets
- Hyper-parameter Optimization
- Larger Multilingual Models
- BigBird Model just Released
- Reformer Multilingual Training



Monolingual QA

Model	SQuAD	SQ3 (512)	SQ3 (4096)
RoBERTa	✓	✓	—
Longformer	✓	✓	✓
RoBERTa-Long	✓	✓	✓
XLM-R	✓	✓	—
XLM-Long	✓	✓	✓

Multilingual QA

Model	XQuAD	XQ3 (512)	XQ3 (4096)	MLQA
XLM-R	✓	✓	—	✓
XLM-Long	✓	✓	✓	✓



References

Links and References

- [4 Biggest Open Problems in NLP](#)
- [The Illustrated Transformer](#)
- [BigBird Presentation](#)
- [WikiHop Dataset](#)
- [Huggingface's Datasets Viewer - SQuAD Dataset](#)
- [Bert Lang Street](#)

- [Master Thesis + Code](#)







Language models for Swedish authorities

The project will build a Swedish BERT model for the Swedish public sector and apply these in a number of applications that are relevant to Swedish authorities.



Peltarion - the operational AI platform

RI.SE

AI
SWEDEN

 **PELTARION**

 **ARBETSFÖRMEDLINGEN**
SWEDISH PUBLIC EMPLOYMENT SERVICE

 **Skatteverket**


**Swedish Agency
for Economic and
Regional Growth**



**National Library
of Sweden**



Swedish Medical Language Data Lab

An extensive amount of medical text data is produced in Swedish healthcare, dental care, and the life science sector. The Swedish Medical Language Data Lab aims to utilize this data to develop language models for the medical domain.



SAHLGRENSKA
SCIENCE PARK



PELTARION

RI.SE

AI
SWEDEN



VÄSTRA
GÖTALANDSREGIONEN



Region Halland



Folkhälsan Sverige



Best practice: Towards an AI-driven organization

- Basic **understanding of AI for everyone**, e.g. through the free [Elements of AI](#) course.
- Ensure “sponsors” and proper **understanding of AI in management**, e.g. with the free [Essential AI handbook for leaders](#)
- Avoid the “analytical ladder”, **AI is different from analytics**. Both are important but **can be built in parallel**
- A truly AI-driven organization happens when **AI becomes a natural component** in every department, product, and service

Mobile first to AI first



...imagine what's possible
when human and machine
work together to solve
society's greatest challenges
like beating disease,
ignorance, and poverty

— Satya Nadella / Microsoft

