# Seq2Seq Modeling for RDF triples to Natural Text

Oral and Written Language Processing
(GCED-UPC) Spring Semester

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**1)** Problem

**2)** System Architecture

**3)** Experiments

**4)** Results

**5)** Next Steps

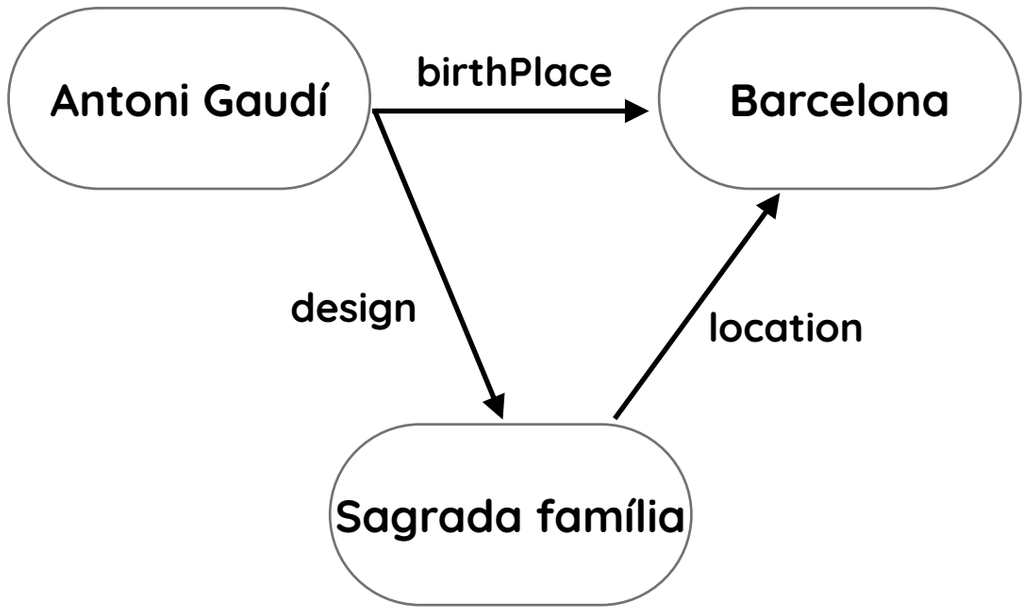
# **Problem -** Contextualization

- **Knowledge Base (KB):** large source of information represented in a structured way.

- **Resources Description Frameworks (RDF):** Base of the information structure which consists in 3 elements and establishes relations between them.

    - Predicate (relation), subject and object (entities)

# **Problem -** Example




(a) Knwoledge graph.

| **RDF Triples** | <Antoni Gaudí, design, Sagrada Família><br><Antoni Gaudí, birthPlace, Barcelona><br><Sagrada Família, location, Barcelona> |
|---|---|

(b) Knwoledge base and its RDF triples.

| **Natural Sentence** | Antoni Gaudí was born in Barcelona, the city where he designed Sagrada Família. |
|---|---|

(c) Corresponding natural language description.

# **Problem -** Description

- **Two main tasks**
    - RDF to Text generation
    - Text to RDF semantic parsing

# **Problem -** Formal Definition

- **Input:** KB denoted as a set of RDFs, $\mathscr{K} := \{r_1, \ldots, r_n\}$ and each RDF is defined as $\langle s_i, p_i, o_i \rangle$ .

- **Output:** sequence of sentences $\mathscr{S}$, each sentence is a sequence of words $[w_1, \ldots, w_m]$ which should be grammatically correct and should also contain all the information present in $\mathscr{K}$.

# **Problem -** Objectives

- **End-to-end Architectures**
    - Encoder-Decoder Convolutional
    - Encoder-Decoder Transformer
- **Model Enhancement**
    - Byte-Pair Encoding
    - Back Translation
    - Embeddings

# **System Architecture -** Approach

- **Natural Language Generation (NLG)**

  · Data to Text - RDF to Text

  · Text to Text  - MachineTranslation

*Albert Gatt and Emiel Krahmer:*
*Survey of the State of the Art in Natural Language Generation: Core tasks, applications and evaluation*

# **System Architecture -** Preprocessing

- **Delexicalisation:** Entity name to Entity type

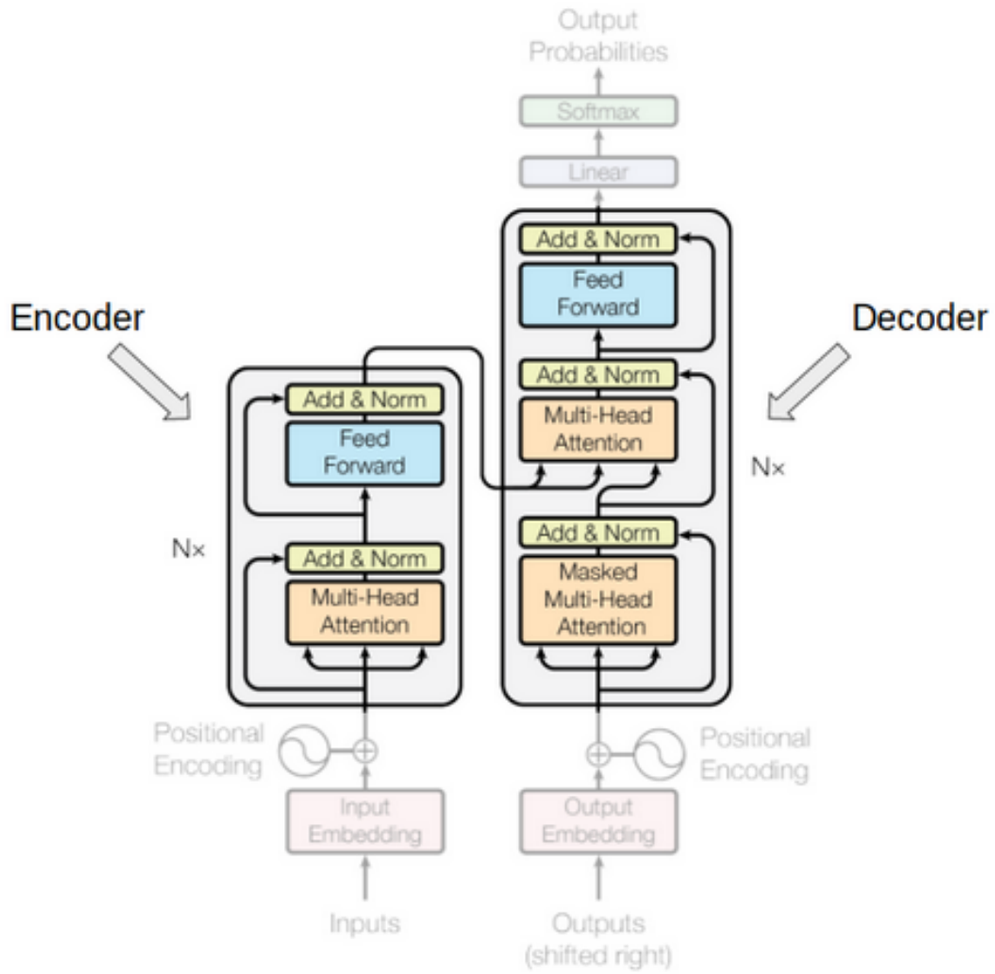
  (Rome, capital of, Italy) → (CITY, CAPITALOF, COUNTRY)

- **Moses Tokenization**

- **Byte-Pair Encoding (BPE)**

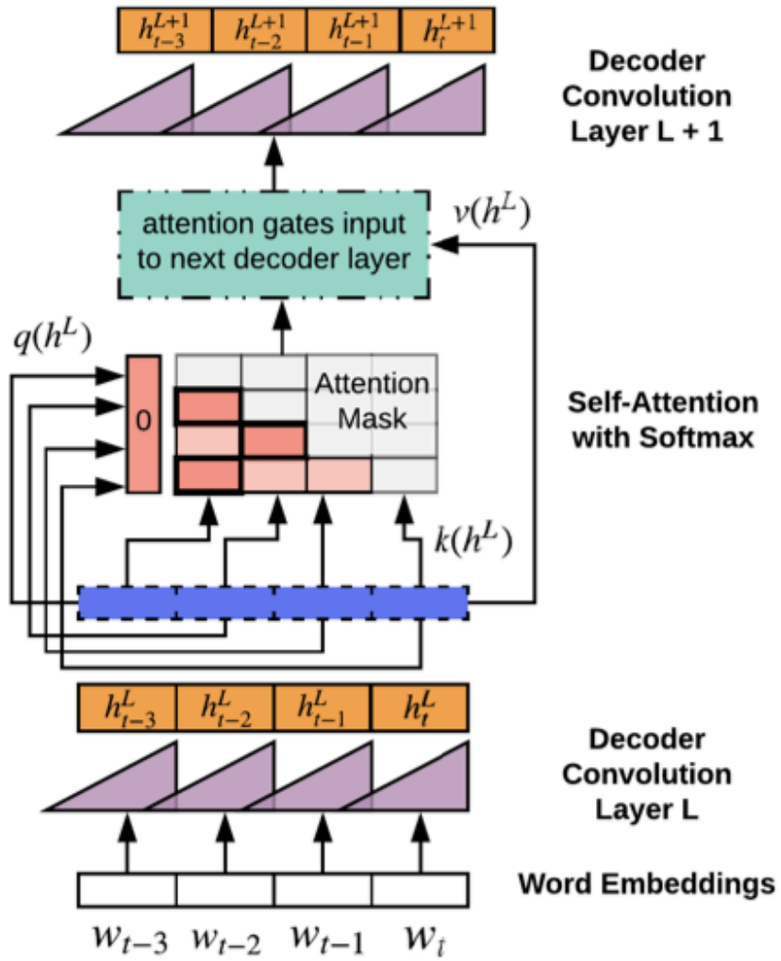
# **System Architecture -** Models

## Transformer




*Ashish Vaswani et al. :*
*Attention Is All You Need*

## Convolutional




*Angela Fan et al. :*
*Hierarchical Neural Story Generation*

# **System Architecture -** Postprocessing

- **Relexicalisation:** Entity type to Entity name

  CITY is the CAPITALOF COUNTRY → Rome is the capital of Italy

- **Moses Detokenization**

- **Byte-Pair Decoding**

# **Experiments -** Byte-Pair Encoding & Embeddings

- **Byte-Pair Encoding**
  - Optimum subwords' number
- **Embeddings**
  - Learned embeddings
  - Pretrained embeddings without BPE and delex.

# **Experiments -** Back Translation

**Back Translation Model**

Text to RDF

BPE + Lexicalise

Transformer Model

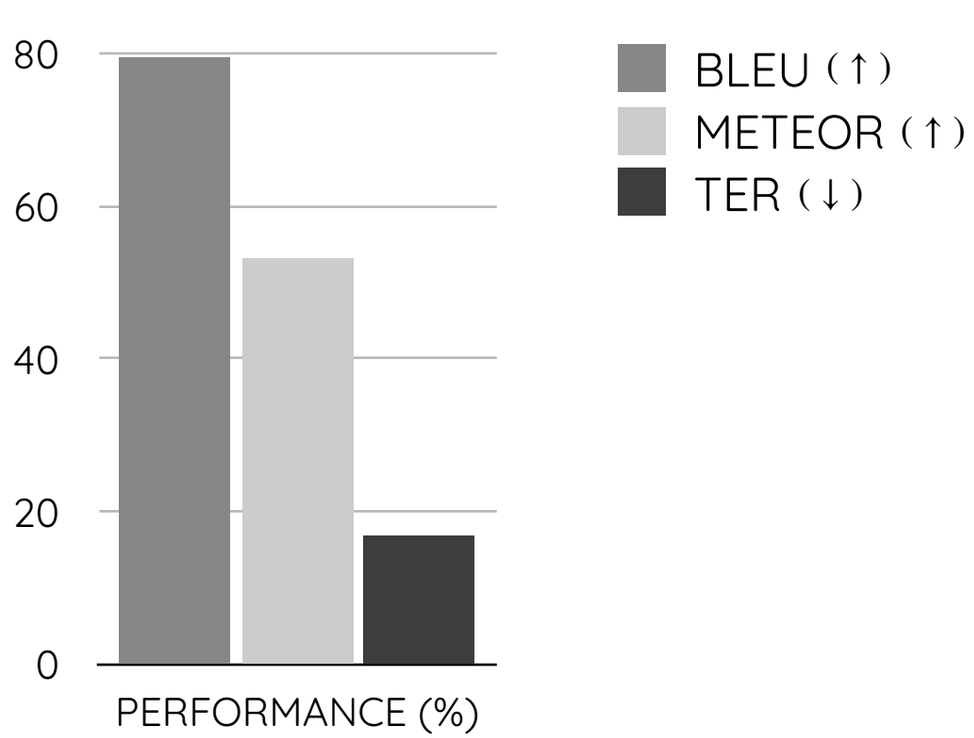
**Predict using Monolingual**

Wikipedia Data Base

Preprocessing DB

# **Experiments -** Back Translation

## Back Translation Performance




## Generated Data

Poor synthetic data

↓

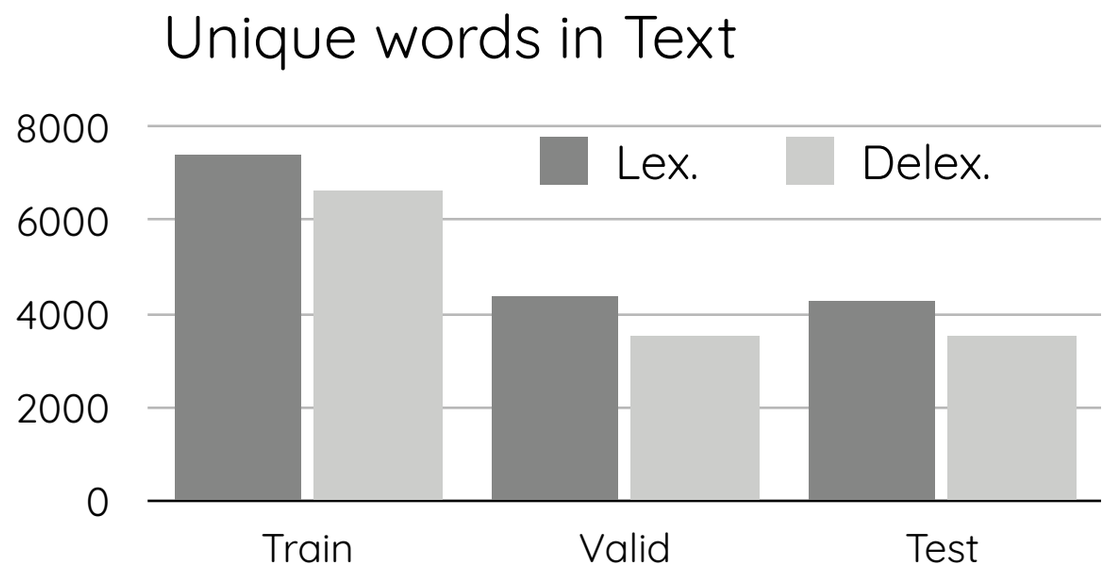
Remove BPE

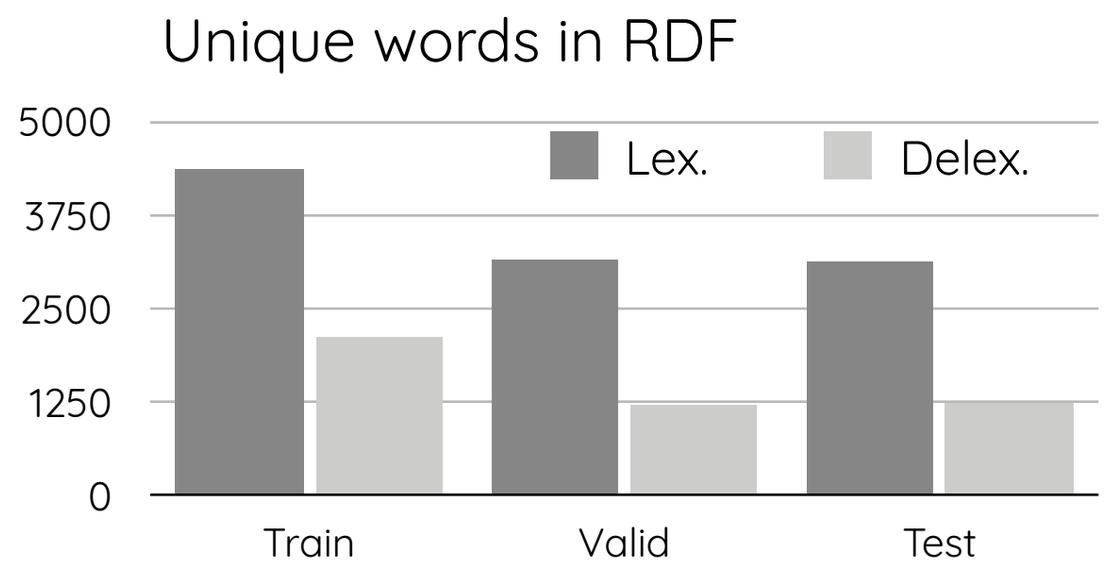
Filter Monolingual text

Pretrained embeddings

# **Results -** Data

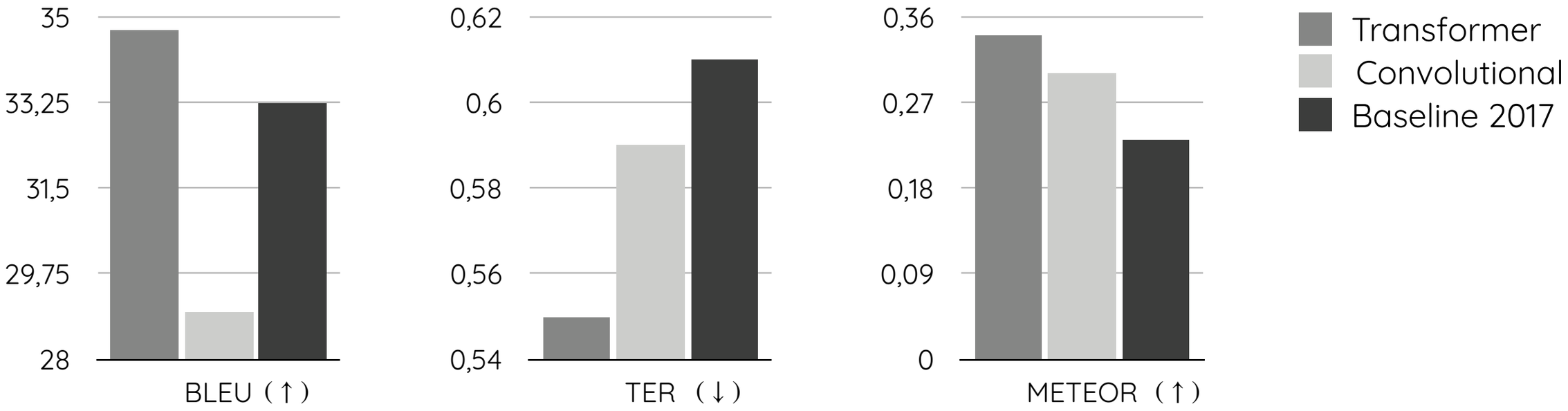
| | Instances |
|---|---|
| **Train** | 34.338 |
| **Valid** | 4.313 |
| **Test** | 4.222 |



# **Results -** Hyperparameter Tuning

- Grid Search on Transformer > 100 models
- Small Search on Convolutional 3 models



# **Results -** System Prediction

| Input | Output |
| --- | --- |
| **Arròs negre** country **Spain** | **Arròs negre** is a food found in **Catalonia** , **Spain** . The main ingredients of **Arròs negre** are White rice , cuttlefish or squid , cephalopod ink , cubanelle peppers |
| **Arròs negre** mainIngredients White rice , cuttlefish or squid , cephalopod ink , cubanelle peppers | |
| **Arròs negre** region **Catalonia** | |
| **Arròs negre** ingredient **Cuttlefish** | |

# **Next Steps -** Short Term

- **Training Phase**
  - More solid results
  - Use BT generated Data
- **Experiments**
  - Influence of BPE
  - Comparative results of embeddings

# **Next Steps -** Long Term

- **Submit Results** WebNLG Challenge 2020

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