E-MIMIC: Empowering Multilingual Inclusive Communication

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Data science for equality, inclusion and well-being challenges
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Outline

- Context and motivation
- Challenges
- Proposed pipeline
- Preliminary case study
- Future works

Inclusive Language Problem

- Increasing attention to **inclusive languages**

- Preserving **diversity** and **inclusion**
  - Il parere **dei direttori tecnici** deve essere acquisito entro l'anno
  - Il parere **della direzione tecnica** deve essere acquisito entro l'anno
  - *The opinion of the technical management must be acquired within the year*

- Automated Machine Translation tools increases the non-inclusive text generation problem

Increasing interest in developing automated solutions to preserve inclusivity and diversity in formal communications

Italian Communication Context

- Noticeable problem in romance languages
  - linguistic feminization
  - Stereotypes

- Italian language case study
  - Italian institutions privilege the usage of the masculine as *"neutral"* form

- In 2018, the ministry of education, university and research proposed the set of guidelines for gender-inclusive language
  - Exploiting the guidelines is time-consuming
  - Exists a very large corpus of documents to be rewritten
  - Lot of linguistic expertise is required

→ **Deep learning** could be an effective tool in **spreading inclusive communication**

Deep Learning for NLP

- **Deep Language Models** achieved **impressive performance** on diverse NLP-related tasks

- They acquire knowledge being **trained on large corpora** available on the web, using unsupervised learning

- Each architecture can be applied to solve specific tasks:
  - Encoder models (e.g., text classification)
  - Decoder models (e.g., text generation)
  - Sequence-to-sequence models (e.g., machine translation)

→ Current **Deep Language models** are **not** trained to **model Inclusive Language**

Inclusive Communication Challenges

1. *How* to define **non-inclusive** communication?

2. *Whether* **Deep Learning** techniques are suitable for modeling inclusive language?

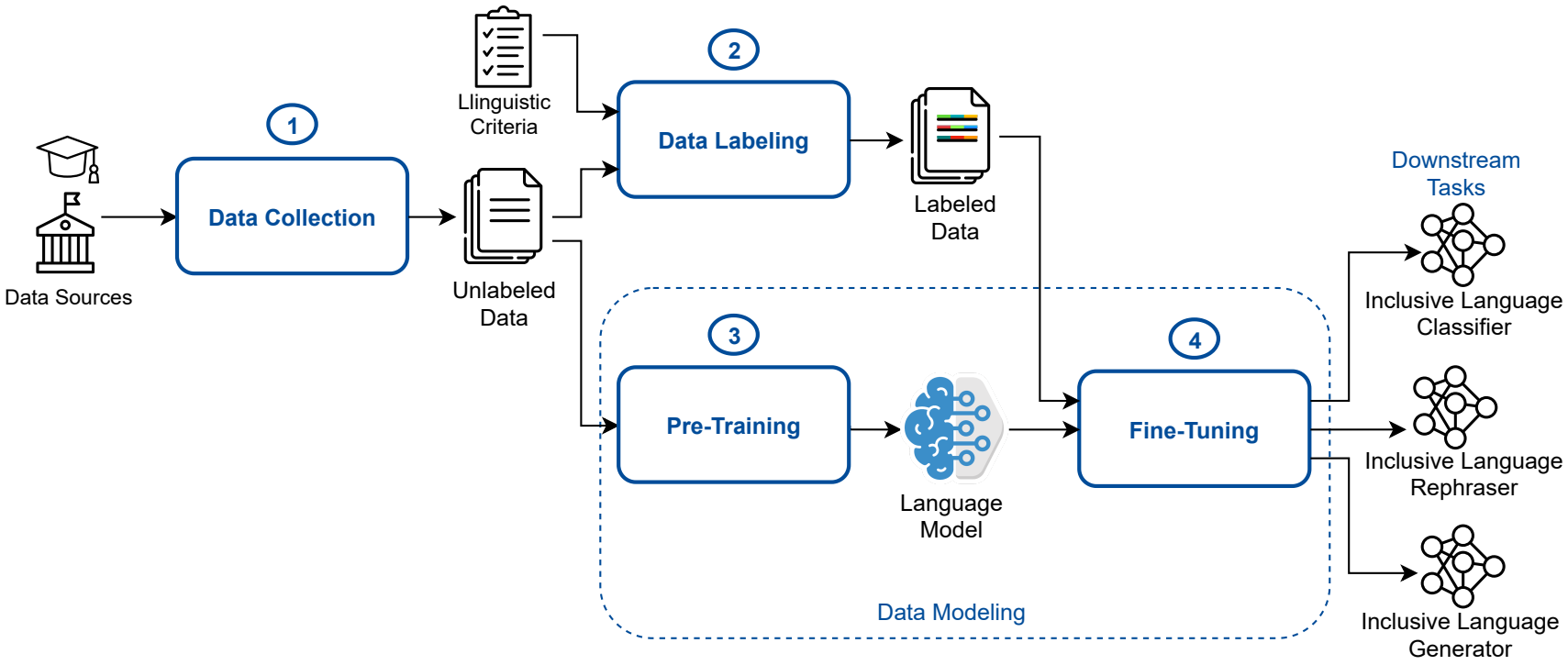
3. *To what extent* **large-scale** collections are suitable for learning pre-trained models?
   - For adaptation to **Inclusive Language tasks**

E-MIMIC

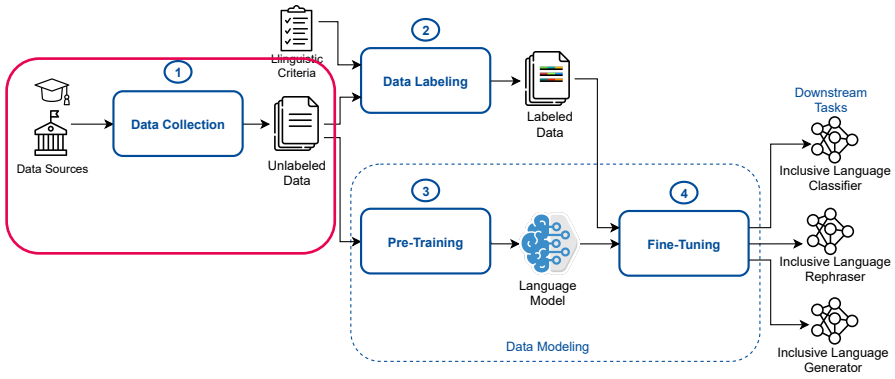
E-MIMIC: **E**mpowering **M**ultilingual **I**nclusive com**M**un**IC**ation

- **Fostering** inclusive communications in real-world scenarios
- **Detecting** and **overcoming** language inclusivity issues
  - Grammatical asymmetry (silencing the feminine form)
  - Semantic asymmetry (presence of stereotypes)
- Exploiting a **deep learning** pipeline to **generalize** and **automate** the process
  - It leverages language models trained on purpose-specific corpora
  - It can detect non-inclusive expressions and suggest inclusive alternatives
- Currently focusing on **Academic** and **Public Administration Italian** documents
  - Can be adapted to different languages and types of documents

E-MIMIC Pipeline



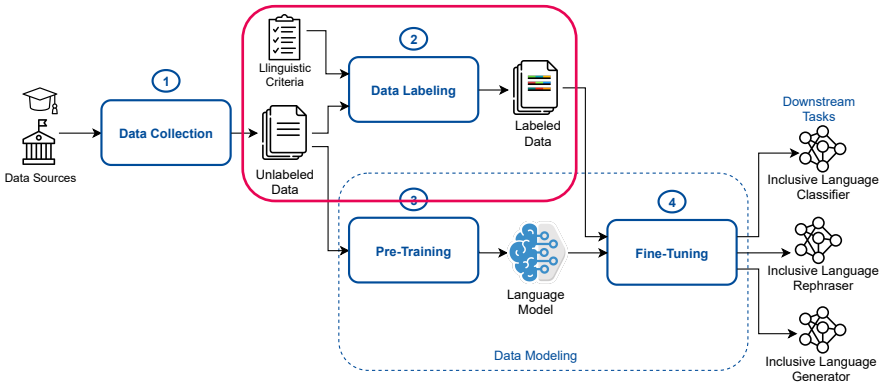
1) Data Collection



- **Limited** amount of **annotated data** for romance languages
  - **Italian** is particularly prone to **non-inclusive language** (first case study)
  - No publicly available dataset annotated for inclusive Italian language detection
- Focus on Inclusive language in:
  - Administrative documents
  - Grants
  - Internal and external policies
  - Calls for applications
- Easily **extendable** to different types of documents

→ Accurate **data collection** and **annotation** is of primary relevance for high-quality results

1) Data Labeling



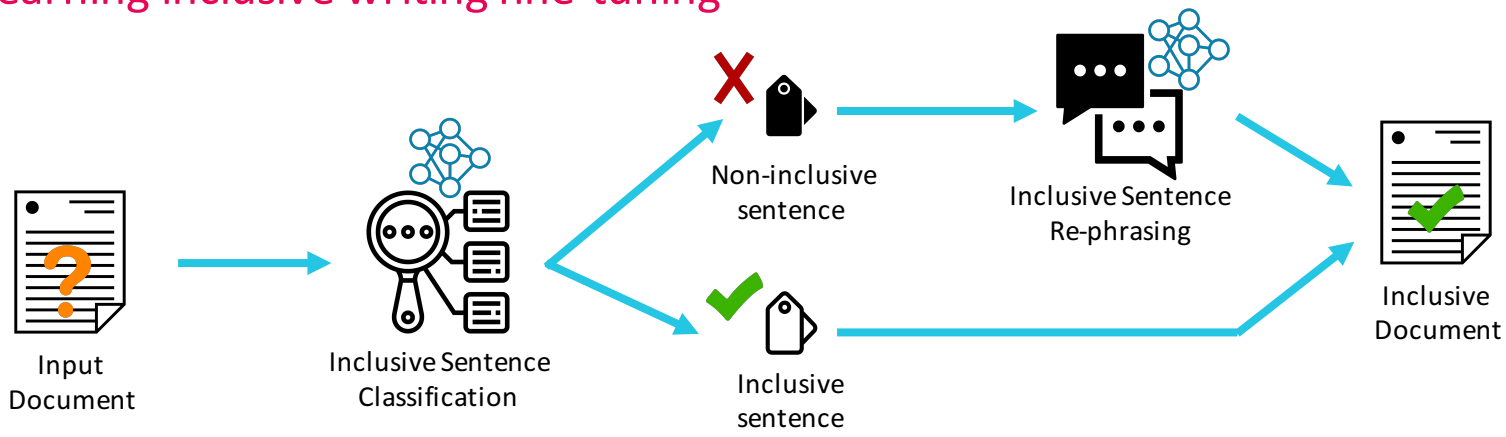
1. Sentence-level splitting
   - Shortest unit containing non-inclusive phrasing
2. Sentence annotation
   - Inclusive label
     - Inclusive, Non-Inclusive, Non-Applicable
   - Part-of-speech tagging of salient linguistic features
     - Cited content, proper names, potentially stereotypical phrases, etc.
   - Type of content
     - Legal, administrative, technical, or informative document
   - Edited sentence part highlighting
   - Inclusive re-phrasing formulation of the sentence
     - One or more valid inclusive re-formulation

→ **Linguistic criteria** design and **annotation** is performed by **Linguistic Experts**

3) Data Modeling

1. Target domain/task specialization
   a) Masked Language Model (MLM) for administrative and academic language specialization
   b) Named Entity Recognition (NER) on Part-of-speech for inclusivity tags
   c) Content classification (i.e., predict whether a sentence contains legal, administrative, technical, or informative content)

2. Learning inclusive writing fine-tuning



Preliminary Case Study

Synthetic dataset

- Inclusive sentence classification (Inclusive *I*, non-inclusive *NI*)

- Template filling procedure
  - Collected 19 templates and 43 seeds
  - producing 822 annotated Inclusive *I* and non-inclusive *NI* samples

Template	**IT:** Occorre richiedere la firma **[blank]** **EN:** One must request the signature of **[blank]**
Syntetic examples	***NI*:** Occorre richiedere la firma degli interessati ***I* :** Occorre richiedere la firma delle persone interessate **EN:** One must request the signature of interested people

Preliminary Case Study

Sentence inclusivity classification

- Randomly selected 80% of the templates for training
  - 70% as training set
  - 10% as validation set
- Remaining 20% of templates as test set
- Templates restricted to either training or test set
  - prevent the model from identifying shallow syntactic patterns
- Fine-tuned a pre-trained BERT checkpoint for Italian language
  - 85% of accuracy on test set (i.e., new unseen templates) for sentence inclusivity classification

→ Promising ability of **deep language models** to effectively **represent inclusive language**

Future Works

- **Inclusive data annotations**
  - Existing documents are manually annotated to detect non-inclusive language
  - Manual rephrasing is proposed for non-inclusive sentences

- **Inclusive language modeling**
  - Deep learning-based language models are trained with a mix of self-supervised and supervised approaches
  - They are trained to solve multiple tasks for the goal of inclusive communication (e.g., classification and reformulation)

- **Multilingual pipeline adaptation**
  - The pipeline proposed for Italian language can be adapted to multiple languages (e.g., other romance languages as French or Spanish)

Thank You!

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