UNIVERSITÀ DI TORINO

AI Applied to the Contracts Analysis of the Italian Public Administrations

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- AI Applied to the Contracts Analysis of the Italian Public Administrations
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Introduction

- In this research, we explored the dataset of the **National Anti-Corruption Authority** (**ANAC**) in Italy on **public procurement** and the **recorses** related to public procurement issued by the **Italian Administrative Justice** (**IAJ**) courts.

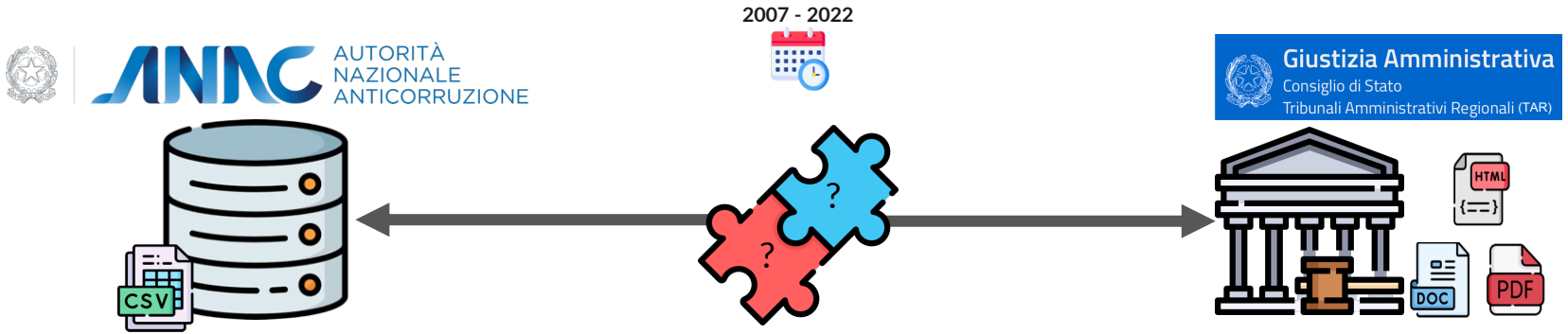
[RQ1]🎯 Our **first goal** was to **identify which procurement led to disputes and recourses** by identifying relevant procurement features.

[RQ2]🎯 Our **second goal** was to **develop a recommender system** on procurement by applying machine learning algorithms and deep neural models to return similar procurement to a given one and find companies as potential bidders, depending on the procurement requirements.

[RQ3]🎯 Our **third goal** is to **automate the analysis** of a public procurement dataset, contract awards, and appeal procedures with **process mining** (**PM**) **techniques**.

Case study

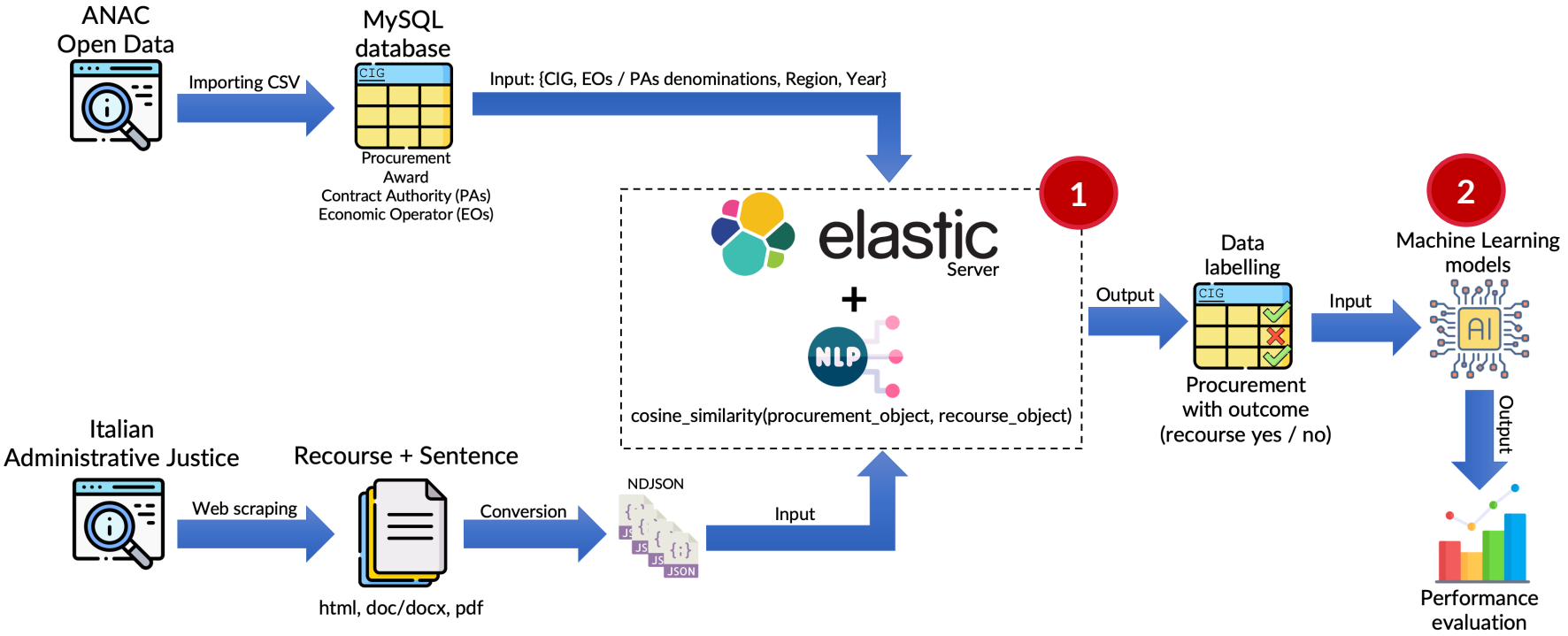
- Our work is based on **two legal datasets** involving the **public procurement process** in Italy.



Italian Public Procurement
🔑 **Identifier**: CIG
(shared key)

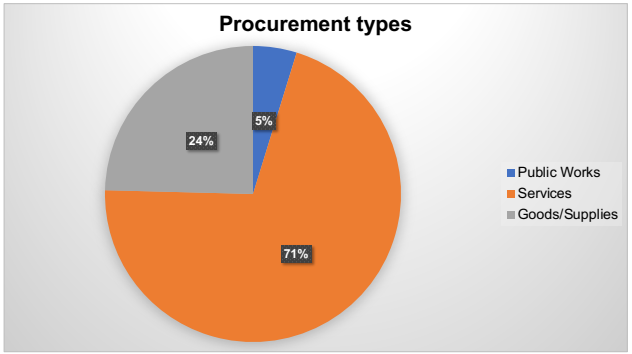
Recourses and Sentences
🔑 **Identifier**: ECLI

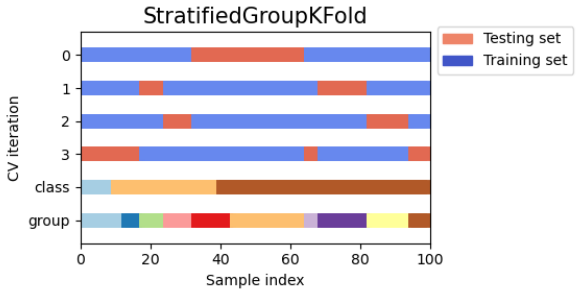
Methodology [RQ1]



Methodology [RQ1]

- The labeled datasets were used as input for the machine learning algorithms, validating the classification models with a *StratifiedGroupKFold* method using as *group* category the procurement type: **Public Works**, **Services**, **Goods/Supplies**.

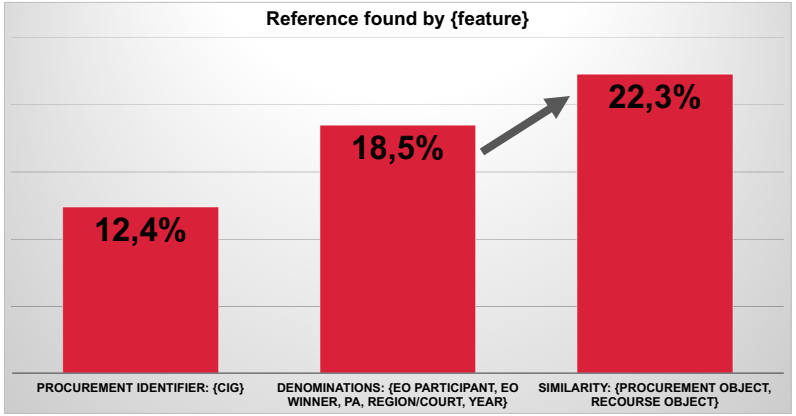




Results [RQ1]

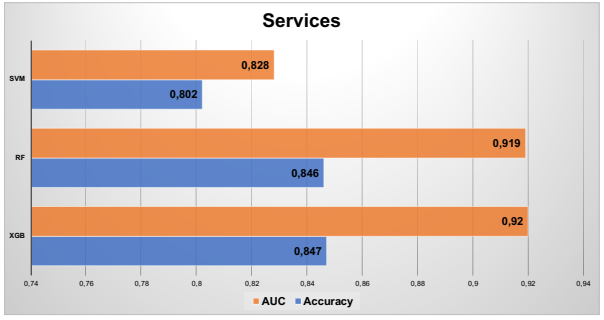
- The following results show how the NLP method of *cosine similarity* improve the ability to recognize a reference between the ANAC and the IAJ datasets based on the available sentences (67,850).

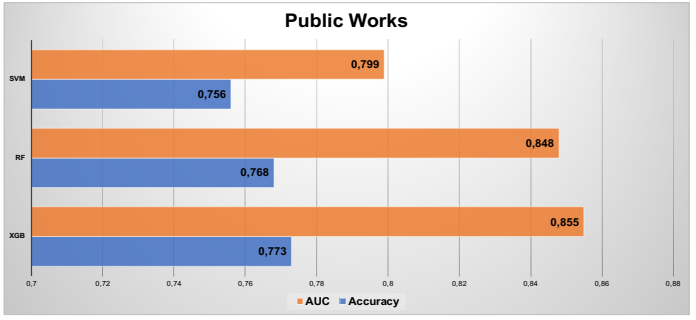
Reference found by {feature}	Total	Overall percentage
Procurement identifier: {CIG}	8,418	12.4%
Denominations: {EO participant, EO winner, PA, Region/Court, Year}	4,178	18.5%
Similarity {procurement object, recourse object}	2,491	22.3%

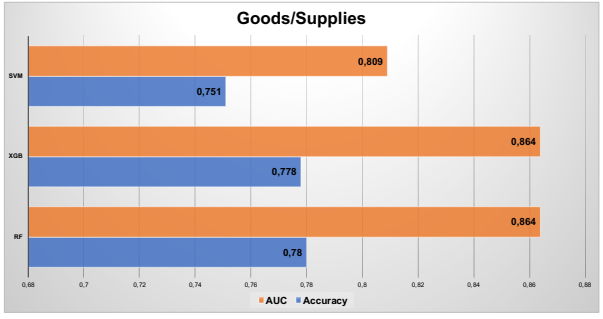


Results [RQ1]

- The following diagrams show the results in terms of **Accuracy** and **AUC** of the models.
  - The top three models were: Extreme Gradient Boosting (XGB), Random Forest (RF) and Support Vector Machine (SVM).

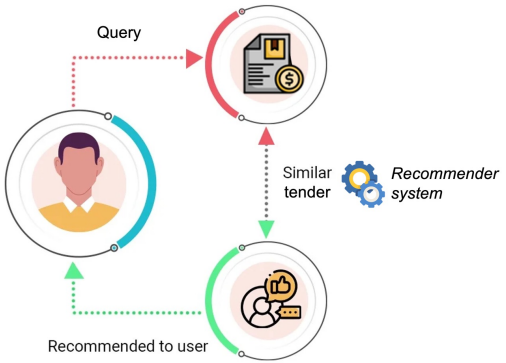






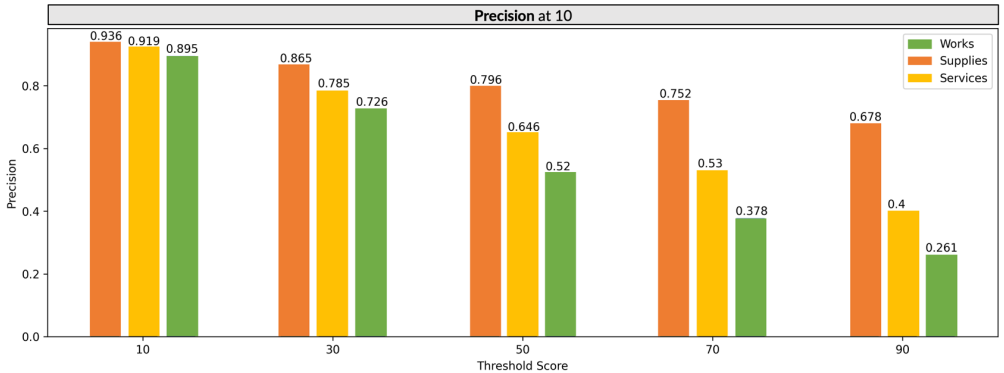
Methodology [RQ2]

- Following the RQ2, we relied on *procurement object* (a summary textual description) to find similar procurement in the dataset.
  - To build an abstract and general representation of the contract's semantic content by training the numerical vectors called *sentence embeddings* using BERT.
  - Successively, given a case of an individual procurement (*query*), we searched for the most similar and relevant ones in the rest of the database using **Sentence-BERT** (**SBERT**) and **Language-agnostic BERT Sentence Embedding** model **(LaBSE BERT)**: they are a multilingual version of BERT and use siamese networks to work on multilingual and Italian corpora.



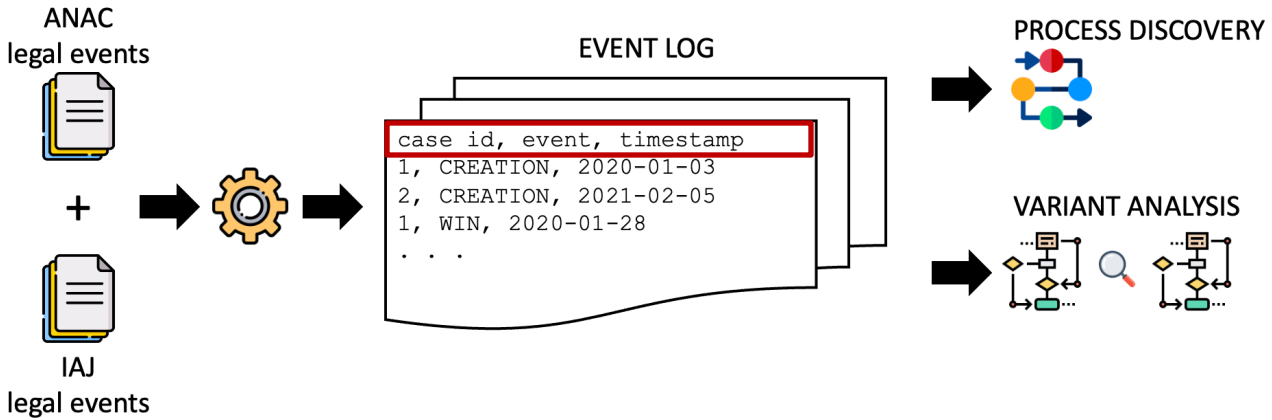
Results [RQ2]

- To evaluate the performance of our recommender system, we decided to evaluate its Precision at 10.
  - Precision at 10 was calculated by a panel of three individuals working separately on a test set of recommendations for 100 random procurement instances for Public Works, Services, and Goods/Supplies.
- We observe how **the recommendation system works better for tenders of Goods/Supplies** (orange bars).



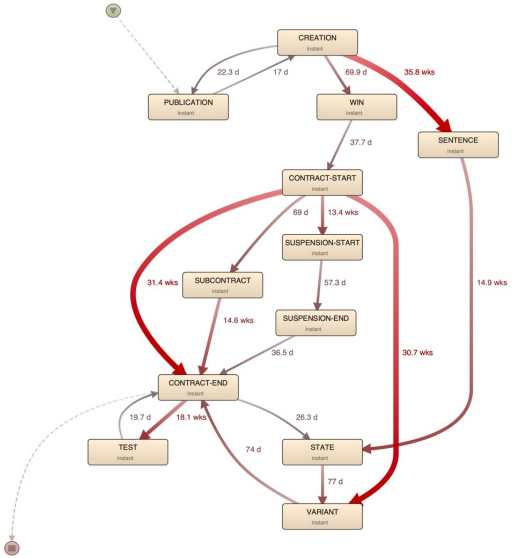
Methodology [RQ3]

- Following RQ3, the ANAC and IAJ merged datasets have been converted into an event log fulfilling the basic requirements for applying PM techniques:
  - each **event** in an *event log* includes at least three basic features: **the identifier** (**case id**) of the process it belongs to, **the name of the activity** which generated the event, and the corresponding execution **timestamp**.



Results [RQ3]

- As a proof of concept for PM, the results were analyzed considering each of the following PM *perspectives*: control-flow, organizational (resource), and time.



Time perspective highlighting **slow transitions** and bottlenecks in some activities of the legal process

Conclusion and future work

- In this research, we explored the dataset of the **National Anti-Corruption Authority** (**ANAC**) in Italy on **public procurement** and the **sentences** related to public procurement issued by the **Italian Administrative Justice** (**IAJ**) courts.
- In **future work**, we plan to investigate furthermore the **explainable AI techniques**.
- From the PM perspective, **future work** concerns the **prediction of features of interest from an organizational perspective**.
  - First, we consider investigating the remaining time after the activity of interest (i.e., the awarding), as well as the successful or unsuccessful outcome of a tender.

End of presentation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