# Progettazione e sviluppo di un classificatore per l’individuazione di commenti non informativi

**Relatori:**
Prof.ssa Nicole Novielli
Prof. Pierpaolo Basile

**Laureando**:
Giuseppe Colavito

# Problema

```
//loop from 1 to N
```

```
// Synchronize changes of the underlying date value with the temporalAccessorValue
```

```java
//loop from 1 to N

for (int i = 1; i < N; i++) {
  System.out.println(i);
}
```

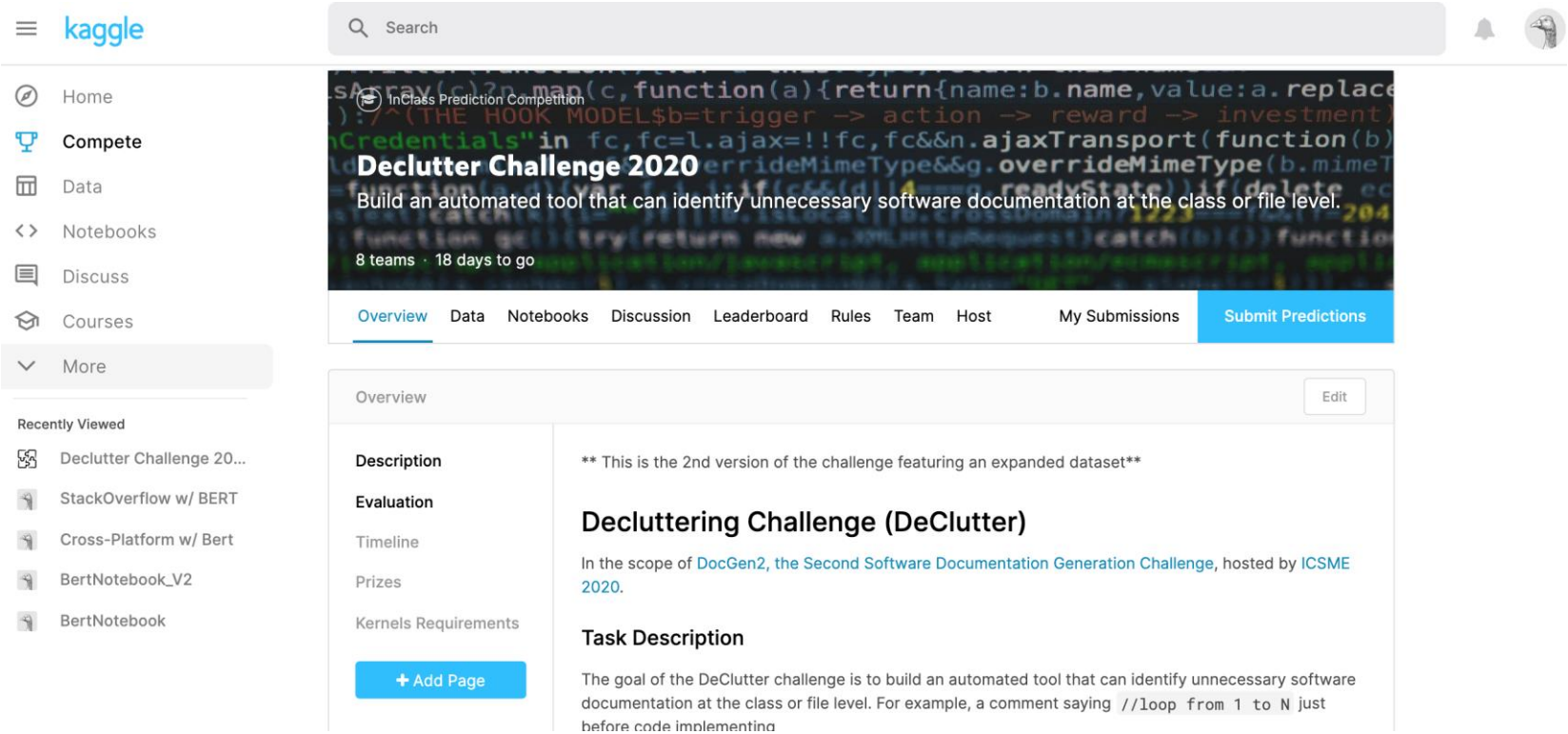
```java
public TemporalAccessorPicker() {
        setConverter(new InternalConverter());

        // Synchronize changes of the underlying date value with the temporalAccessorValue
        BindingsHelper.bindBidirectional(valueProperty(), temporalAccessorValue,
                TemporalAccessorPicker::addCurrentTime,
                TemporalAccessorPicker::getDate);
    }
```

```java
//loop from 1 to N

for (int i = 1; i < N; i++) {
  System.out.println(i);
}
```

```java
public TemporalAccessorPicker() {
        setConverter(new InternalConverter());

        // Synchronize changes of the underlying date value with the temporalAccessorValue
        BindingsHelper.bindBidirectional(valueProperty(), temporalAccessorValue,
                TemporalAccessorPicker::addCurrentTime,
                TemporalAccessorPicker::getDate);
    }
```

# Decluttering challenge

- **Obiettivo**: Costruire uno classificatore per il riconoscimento di commenti *non informativi*
- **Task binario:** Commenti non informativi etichettati come *"Non-information = Yes"*

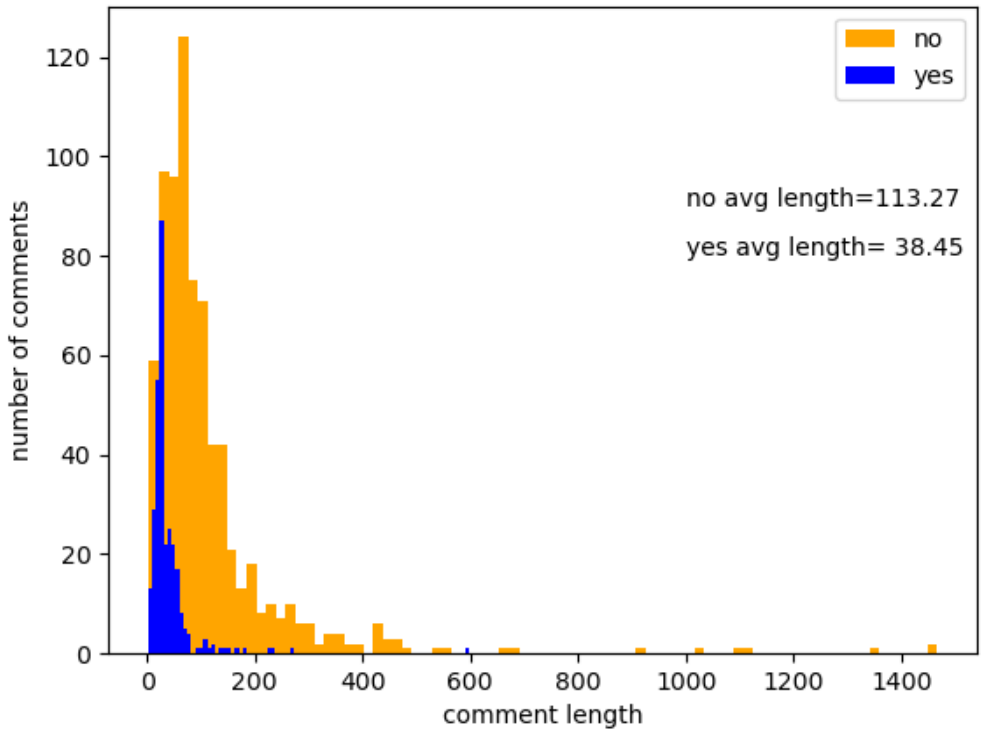


# Dataset

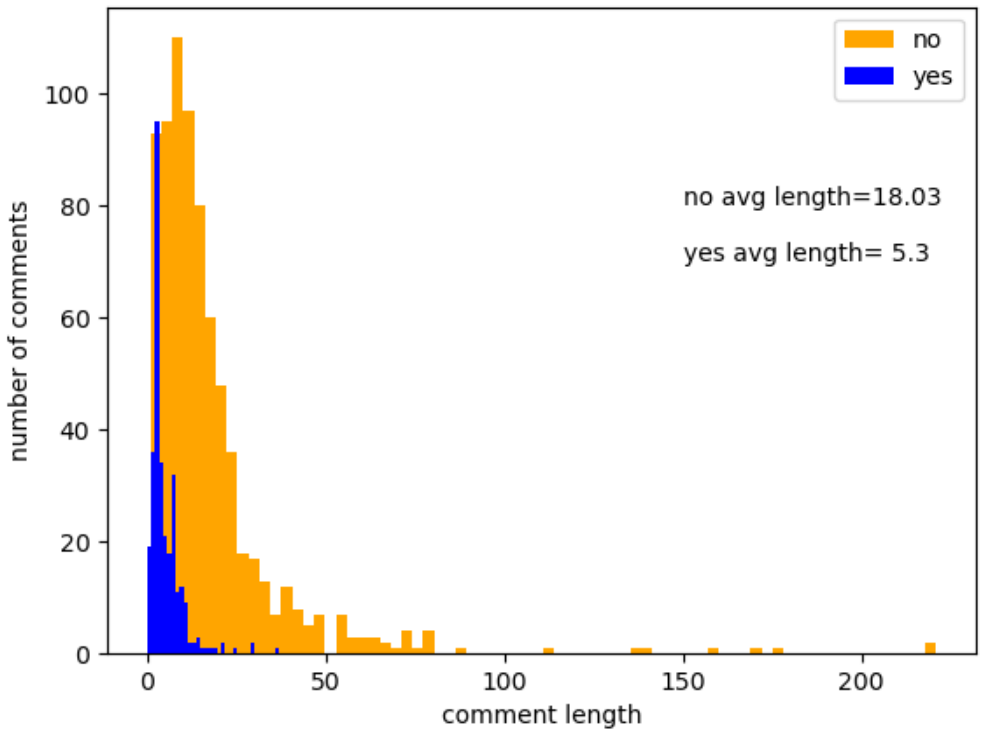
- Repository *Jabref*
- Linguaggio Java

| | Non-information | | Totale |
|---|---|---|---|
| | *Yes* | *No* | |
| Training set | 304 (**29%**) | 743 (**71%**) | **1047** |
| Test set | … | … | **261** |

# Lunghezza del commento




*Analisi lunghezza (numero lettere) commenti*



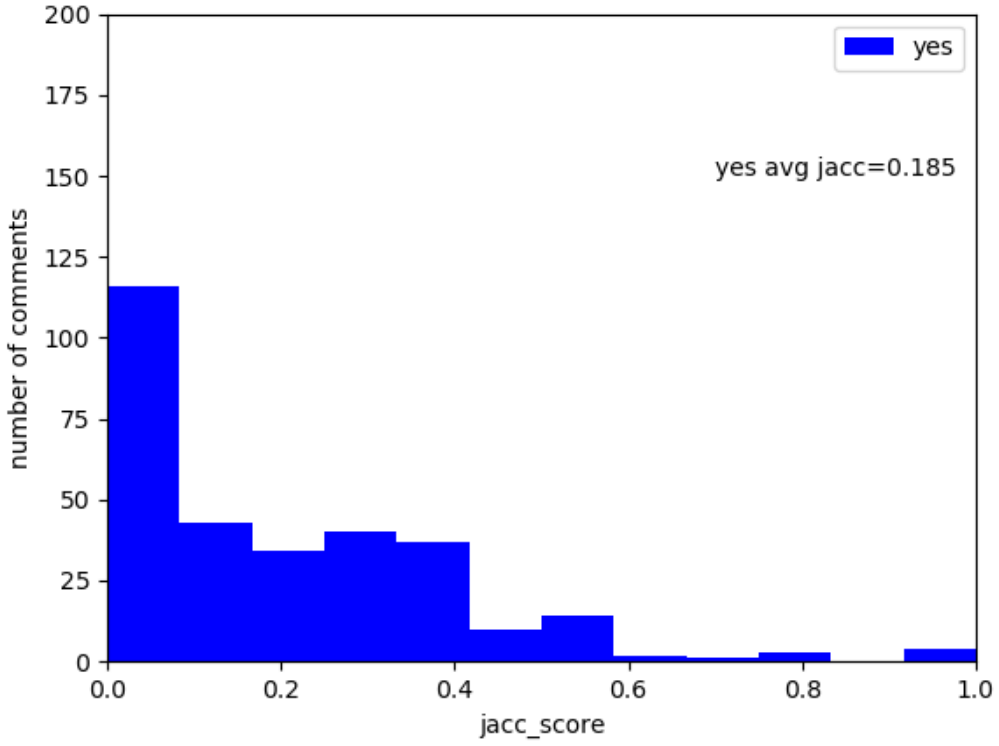

*Analisi lunghezza (numero di parole) commenti*

# Indice di Jaccard

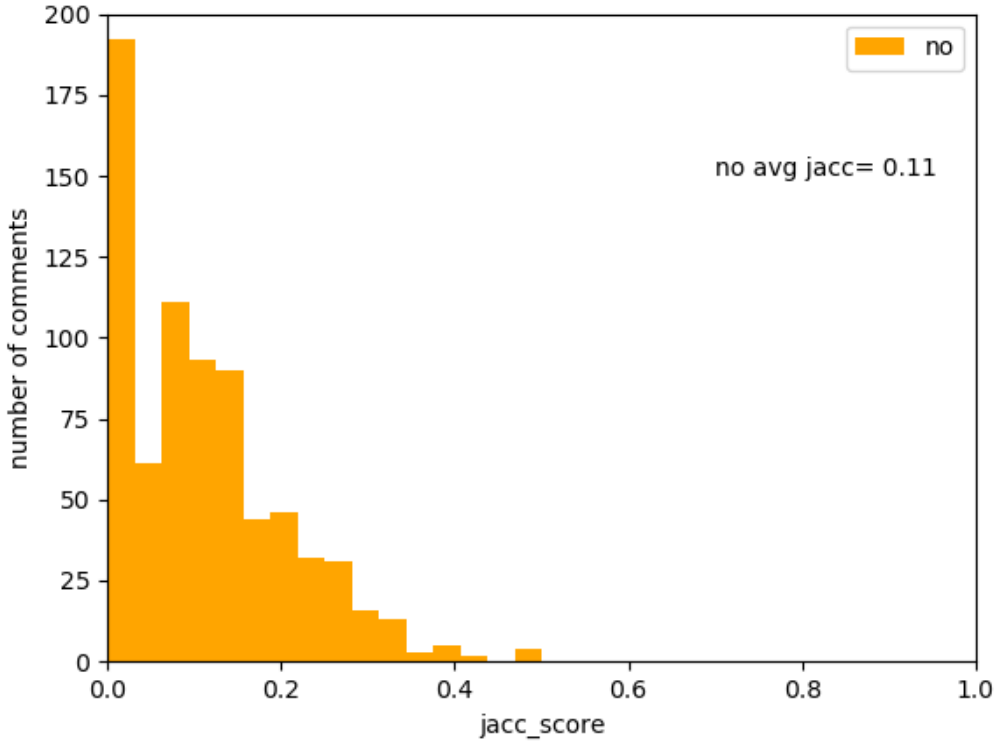
```
// update all tab titles
updateAllTabTitles();
```

$$J(A,B) = \frac{|A \cap B|}{|A \cup B|}$$

# Indice di Jaccard




*Analisi indice di Jaccard su commenti "Non-information=Yes"*




*Analisi indice di Jaccard su commenti "Non-information=No"*

# Posizione

1

```
public String getSchema() throws SQLException {

// Auto-generated method stub

return null;

}
```

2

```
@Override
public void abort(Executor executor) throws SQLException {

// Auto-generated method stub

}
```

# Posizione

3

```
return Optional.of(suffix); // return the first one we found, anyway.

}
```

4

```
} else { //Dir must be a folder, not a file

if (!Files.isDirectory(directory)) {

directory = directory.getParent();

}
```

# Posizione

| Position | Non-Information = Yes | Non-Information = No |
|---|---|---|
| **method declaration** | 83 (28%) | 200 (28%) |
| **if** | 25 (8%) | 56 (8%) |
| **method call** | 64 (22%) | 146 (20%) |
| **assignment** | 55 (19%) | 155 (22%) |
| **class declaration** | **9 (3%)** | **111 (16%)** |
| **return** | 43 (14%) | 19 (2%) |
| **cycle** | 12 (4%) | 16 (2%) |

# Tags

| Tag | Non-Information = Yes | Non-Information = No |
|---|---|---|
| **param** | 5 (36%) | 6 (6%) |
| **return** | 4 (29%) | 7 (7%) |
| **see** | 0 | 2 (2%) |
| **link** | **3 (21%)** | **74 (74%)** |
| **Override** | 0 | 1 (1%) |
| **implNote** | 1 (7%) | 1 (1%) |
| **code** | 0 | 7 (7%) |
| **inheritDoc** | 1 (7%) | 0 |

# Tipo

Java offre tre modi alternativi per commentare il codice sorgente:

- Line

```
boolean maskText = (textInputControl instanceof PasswordField); // (maskText("A") != "A");
```

- Block

```
MOVE_TAB_ARROW(MaterialDesignIcon.ARROW_UP_BOLD), /*css: arrow-up-bold */
```

- Javadoc

```
/**
* This class contains some code taken from {@link
com.sun.javafx.scene.control.behavior.TextInputControlBehavior},
* witch is not accessible and thus we have no other choice.
* TODO: remove this ugly workaround as soon as control behavior is made public
* reported at https://github.com/javafxports/openjdk-jfx/issues/583
*/
```

# Tipo

| | Non-information = Yes | Non-information = No |
|---|---|---|
| Javadoc | 66 (22%) | 305 (41%) |
| Line | 219 (72%) | 424 (57%) |
| Block | 19 (6%) | 14 (2%) |

# Valutazione

Metriche utilizzate:

Accuracy, Precision, Recall, F1-score, Matthews Correlation Coefficient

Baseline:

- Classificatore che predice sempre la classe di maggioranza
- Classificatore Bag-of-words

Validazione:

- K-Fold cross validation (K=10)

# Modelli

**Features extratestuali**

- Lunghezza
- Indice di Jaccard
- Posizione
- Tags
- Tipo

**Features testuali ed extratestuali**

- Lunghezza
- Indice di Jaccard
- Posizione
- Tags
- Tipo
- *Tf-idf*
- *Word-count*

# Risultati
# sole features extratestuali

| classifier | accuracy | precision | recall | f1-score | matthews corrcoef |
|---|---|---|---|---|---|
| Baseline Dummy | 0.71 | 0.35 | 0.5 | 0.41 | 0.0 |
| Baseline Tf-idf | 0.82 | 0.79 | 0.75 | 0.76 | 0.53 |
| BernoulliNB | 0.7 | 0.69 | 0.73 | 0.68 | 0.41 |
| LinearSVC | 0.81 | 0.78 | 0.74 | 0.76 | 0.52 |
| SVC (poly degree=2) | 0.74 | 0.75 | 0.58 | 0.57 | 0.27 |
| MLPClassifier | 0.83 | 0.79 | 0.77 | 0.78 | 0.57 |
| RandomForestClassifier | 0.82 | 0.78 | 0.76 | 0.77 | 0.54 |
| **AdaBoostClassifier** | **0.84** | **0.82** | **0.78** | **0.8** | **0.6** |
| BaggingClassifier | 0.82 | 0.78 | 0.76 | 0.77 | 0.54 |
| ExtraTreesClassifier | 0.81 | 0.77 | 0.75 | 0.76 | 0.52 |
| GradientBoostingClassifier | 0.83 | 0.8 | 0.77 | 0.78 | 0.57 |
| LogisticRegression | 0.81 | 0.78 | 0.75 | 0.76 | 0.53 |
| DecisionTreeClassifier | 0.78 | 0.73 | 0.73 | 0.73 | 0.45 |
| SGDClassifier | 0.8 | 0.77 | 0.74 | 0.74 | 0.5 |
| SoftVoting | 0.83 | 0.8 | 0.77 | 0.78 | 0.57 |
| HardVoting | 0.84 | 0.81 | 0.78 | 0.79 | 0.59 |

Baseline  Miglior performance

# Risultati
# combinazione di tf-idf e features extratestuali

| classifier | accuracy | precision | recall | f1-score | matthews corrcoef |
|---|---|---|---|---|---|
| Baseline Dummy | 0.71 | 0.35 | 0.5 | 0.41 | 0.0 |
| Baseline Tf-idf | 0.82 | 0.79 | 0.75 | 0.76 | 0.53 |
| BernoulliNB | 0.73 | 0.72 | 0.77 | 0.72 | 0.49 |
| LinearSVC | 0.83 | 0.8 | 0.77 | 0.79 | 0.58 |
| SVC (poly degree=2) | 0.74 | 0.71 | 0.58 | 0.57 | 0.25 |
| MLPClassifier | 0.8 | 0.76 | 0.75 | 0.75 | 0.51 |
| RandomForestClassifier | 0.84 | 0.83 | 0.77 | 0.79 | 0.6 |
| **AdaBoostClassifier** | **0.84** | **0.81** | **0.8** | **0.81** | **0.62** |
| BaggingClassifier | 0.84 | 0.82 | 0.78 | 0.79 | 0.6 |
| ExtraTreesClassifier | 0.83 | 0.81 | 0.74 | 0.76 | 0.55 |
| GradientBoostingClassifier | 0.85 | 0.83 | 0.79 | 0.8 | 0.61 |
| LogisticRegression | 0.82 | 0.79 | 0.76 | 0.77 | 0.54 |
| DecisionTreeClassifier | 0.81 | 0.77 | 0.78 | 0.77 | 0.55 |
| SGDClassifier | 0.83 | 0.8 | 0.79 | 0.79 | 0.59 |
| **SoftVoting** | **0.85** | **0.83** | **0.8** | **0.81** | **0.62** |
| **HardVoting** | **0.85** | **0.83** | **0.79** | **0.81** | **0.62** |

Baseline  Miglior performance

# Valutazione su test set (Kaggle)

| Modello | Voting | F1-Score |
|---|---|---|
| Bag-of-Words (word-count) e features extratestuali | hard | 0.81 |
| Bag-of-Words (tf-idf) e features extratestuali | hard | 0.80 |
| Features extratestuali | hard | 0.79 |
| Bag-of-Words (word-count) e features extratestuali | soft | 0.77 |
| Bag-of-Words (tf-idf) e features extratestuali | soft | 0.77 |
| Features extratestuali | soft | 0.76 |
| Bag-of-Words (tf-idf) | hard | 0.74 |
| Bag-of-Words (tf-idf) | soft | 0.73 |

Miglior performance

# Classifica pubblica (Kaggle)

| # | Team Name | Notebook | Team Members | Score | Entries | Last |
|---|---|---|---|---|---|---|
| 1 | codeup-yang | | | 0.86923 | 14 | 2d |
| 2 | ZZZ | | | 0.85384 | 5 | 3d |
| 3 | fire | | | 0.83076 | 4 | 3d |
| 4 | i'm here | | | 0.81538 | 30 | 3d |

Your Best Entry

Your submission scored 0.80000, which is not an improvement of your best score. Keep trying!

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | BTW | | | 0.76153 | 9 | 1mo |
| 6 | NPW | | | 0.75384 | 4 | 1mo |
| 7 | [Deleted] | | | 0.73846 | 5 | 1mo |
| 8 | Boda0124 | | | 0.73846 | 4 | 1mo |

# Sviluppi futuri

- Supporto per altri linguaggi di programmazione (attualmente solo Java)
- Supporto per altre lingue (attualmente solo inglese)
- Replicare lo studio su dataset più numerosi e bilanciati
- Integrazione del “declutter” in IDE di sviluppo

GRAZIE PER L’ATTENZIONE