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***BEST SPORTS*: A PORTUGUESE COLLECTION OF DOCUMENTS FOR SEMANTICS-CONCERNED TEXT MINING RESEARCH**


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# RELATÓRIOS TÉCNICOS


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# *BEST sports*: a Portuguese collection of documents for semantics-concerned text mining research

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**Abstract:**

The availability of labeled text collections is a common need in the text mining research community. These collections are used for both learning and evaluating text mining models. In this technical report, we present the *BEST sports* collection. This collection of documents written in Portuguese was collected, prepared, and provided to be used as benchmarking collection in text mining research. Considering real application scenarios, we created four datasets, which correspond to problems of different semantic complexity levels. The use of different datasets of the same text collection allows the evaluation of text mining methods at different levels of semantic complexity.

**Keywords:** Text mining, Benchmarking Text Collection, Datasets, Semantics.

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# 1. Introduction

A huge amount of text data is created daily, either in social networks and the Web or inside organizations. Text mining techniques have become essential for supporting knowledge discovery as the volume and variety of digital text documents have increased. Text sources, as well as text mining applications, are varied. Among the text mining applications, we can mention automatic text classification, text clustering and topic hierarchy building, sentiment analysis, information extraction, and recovery of documents and multimedia data.

Despite the text mining task, a common need in the text mining research community is the availability of labeled text collections. These collections are used for learning a model and for evaluating it (Aggarwal, 2014; Aggarwal & Zhai, 2012). In automatic text classification process, for instance, supervised machine learning algorithms use labeled data (documents with known class labels) to learn a classification model (classifier). These classification models are also evaluated based on labeled data, comparing the classifier answers for new instances to their true known labels. Besides, the evaluation of unsupervised learning methods is often done with the use of labeled data (a gold standard solution).

In this technical report, we present the *BEST sports* collection, which was prepared for supporting text mining research. *BEST sports* collection is composed of Portuguese news articles about sports and it is organized into four datasets. Each dataset may be seen as an independent gold standard, related to a specific organization objective. We construct the datasets to simulate real text mining application scenarios, in which different users or situations require different organizations (or classifications) for the same text collection. Moreover, having different versions of the same text collection allows the evaluation of text mining methods at different levels of semantic complexity. *BEST sports* documents are available at `http://sites.labic.icmc.usp.br/rsinoara/bestsports`.

The remainder of this technical report is organized as follows. Section 2 describes the *BEST sports* collection. Section 3 presents an analysis of *BEST sports* datasets, considering their semantic complexity. Section 4 presents the labeling process conducted to build the semantic organization datasets.

# 2. *BEST sports* collection

*BEST sports* is a collection of sports news, written in Portuguese. The documents were extracted from *BEST sports* website[1], whose main focus is news and results of the Olympic Games and the most important world championships of several sports. The *Best sports* collection contains 881 short news articles (from 383 to 2779 characters), referring to 66 sports or sporting events. The articles were published from August 1999 to August

[1]BEST sports archive: `http://bestsports.com.br/db/notarqhome.php`

2008. The largest amount of documents is from the year 2004, mainly due to Athens Summer Olympics. Each of the 881 articles has a class label, according to the website categorization, and corresponds to either a specific sport or a certain sporting event. The first group of class labels is composed of articles that report games or competition results of the specific sport, for example, an article could report the podium of the first round of Formula 1 World Championship. The second group of class labels is composed of articles that report some fact related to a sporting event in general, as an example, an article could report an Olympic Games Opening Ceremony. Taking into account these class labels, the dataset is unbalanced. Table 1 presents the class distribution of *BEST sports* collection. The top 10 class labels correspond to 502 articles, i.e., more than one half of the total number of documents.

Four datasets are available for *BEST sports* collection. The first dataset, named *BS-full*, is composed of 881 documents organized into 66 classes of the website categorization. The other three datasets are composed of documents from the four larger classes: *Fórmula 1* (Formula 1), *Motovelocidade* (MotoGP), *Futebol* (Soccer), and *Tênis* (Tennis). This subset, named *BEST sports - Top4*, has 283 documents. The first *BEST sports - Top4* dataset corresponds to the website classification. The second and third datasets are related to the performance of Brazilian athletes. In order to create these two datasets, the documents were manually labeled considering this different point of view. Each one of the 283 documents received one of the four possible labels: BRvenceu (*"Brazilian won"*), BRnaoVenceu (*"Brazilian did not win"*), BRnaoCitado (*"No Brazilian mentioned"*) or NaoDefinido (*"Not defined"*)[2]. Details of the labeling process are presented in Section 4.

Thus, the four datasets of the *BEST sports* collection are the following.

1. *BS-full*: categorization by sport;
2. *BS-topic*: categorization by sport;
3. *BS-semantic*: categorization by the performance of Brazilian athletes;
4. *BS-topic-semantic*: categorization by both sport and athletes' performance.

Table 2 presents some characteristics of these four datasets. An analysis of their semantic complexity level is presented in next section.

[2]The label "Not defined" refers to documents that do not report the results of a competition or report both Brazilian victory and defeat.

Table 1: Class distribution of *BEST sports* collection

| Class | Label | # Docs |
|---|---|---|
| Formula 1 | ESP_FORMULA_1 | 91 |
| Soccer | ESP_FUTEBOL | 68 |
| MotoGP | ESP_MOTOVELOCIDADE | 64 |
| Tennis | ESP_TENIS | 60 |
| Volleyball | ESP_VOLEIBOL | 52 |
| Athletics | ESP_ATLETISMO | 42 |
| Beach Volleyball | ESP_VOLEI_DE_PRAIA | 33 |
| Summer Olympic Games | CMP_JOGOS_OLIMPICOS_VERAO | 32 |
| Swimming | ESP_NATACAO | 32 |
| Sailing | ESP_IATISMO | 28 |
| Basketball | ESP_BASQUETE | 22 |
| Gymnastics | ESP_GINASTICA | 18 |
| Handball | ESP_HANDEBOL | 17 |
| Pan American Games | CMP2_JOGOS_PANAMERICANOS | 16 |
| Judo | ESP_JUDO | 16 |
| Mountain Biking | ESP_MOUNTAIN_BIKE | 16 |
| Motocross | ESP_MOTOCROSS | 14 |
| Shooting | ESP_TIRO | 14 |
| Equestrian | ESP_HIPISMO | 12 |
| Diving | ESP_SALTOS_ORNAMENTAIS | 12 |
| Formula 3000 | Formula_3000 | 12 |
| Baseball | ESP_BEISEBOL | 11 |
| Cycling | ESP_CICLISMO | 11 |
| Rally | ESP_RALI | 11 |
| Triathlon | ESP_TRIATLO | 11 |
| Cross-Country Rally | ESP_RALI_XC_CARROS | 9 |
| Cross-Country Rally Bikes | ESP_RALI_XC_MOTOS | 8 |
| Rowing | ESP_REMO | 8 |
| TaeKwonDo | ESP_TAEKWONDO | 8 |
| Table Tennis | ESP_TENIS_MESA | 8 |
| Boxing | ESP_BOXE | 7 |
| Wrestling | ESP_LUTA | 7 |
| IndyCar | IRL | 7 |
| Summer Paralympic Games | CMP2_JOGOS_PARAOLIMPICOS_VERAO | 6 |
| Fencing | ESP_ESGRIMA | 6 |
| Powerboating | ESP_MOTONAUTICA | 6 |
| Supercross | ESP_SUPERCROSS | 6 |
| Enduro | ESP_ENDURO | 5 |
| Rugby | ESP_RUGBI | 5 |
| Archery | ESP_TIRO_ARCO | 5 |
| Trial | ESP_TRIAL | 5 |
| Badminton | ESP_BADMINTON | 4 |
| Canoeing | ESP_CANOAGEM | 4 |
| Futsal | ESP_FUTSAL | 4 |
| Weightlifting | ESP_LEVANTAM_PESO | 4 |
| Champ Car | CART | 4 |
| Duathlon | ESP_DUATLO | 3 |
| Karate | ESP_KARATE | 3 |
| Karting | ESP_KART | 3 |
| Synchronised Swimming | ESP_NADO_SINCRONIZADO | 3 |
| Modern Pentathlon | ESP_PENTATLO_MODERNO | 3 |
| Surfing | ESP_SURF | 3 |
| Winter Olympic Games | CMP_JOGOS_OLIMPICOS_INVERNO | 2 |
| BMX Cycling | ESP_BICICROSS | 2 |
| Skiing | ESP_ESQUI | 2 |
| Field Hockey | ESP_HOQUEI | 2 |
| Water polo | ESP_POLO_AQUATICO | 2 |
| Squash | ESP_SQUASH | 2 |
| Superbike | ESP_SUPERBIKE | 2 |
| Chess | Xadrez | 2 |
| Winter Paralympic Games | CMP2_JOGOS_PARAOLIMPICOS_INVERNO | 1 |
| Aquathlon | ESP_AQUATLO | 1 |
| Bobsleigh | ESP_BOBSLED | 1 |
| Luge | ESP_LUGE | 1 |
| Snowboarding | ESP_SNOWBOARD | 1 |
| Softball | ESP_SOFTBOL | 1 |

Table 2: Description of *BEST sports* datasets

| Dataset | # Docs | # Classes | Class S. D. | Majority Class | Average Silhouette Width | Semantic Complexity |
|---|---|---|---|---|---|---|
| *BS-full* | 881 | 66 | 2.05% | 10.33% | 0.0822 | topic |
| *BS-topic* | 283 | 4 | 4.91% | 32.16% | 0.1978 | topic |
| *BS-semantic* | 283 | 4 | 9.04% | 32.86% | 0.0083 | semantic |
| *BS-topic-semantic* | 283 | 15 | 3.85% | 16.96% | 0.0173 | semantic |

# 3. Analysis of *BEST sports* datasets

The work of Sinoara et al. (2017) defined two levels of semantic complexity for document organization problems. The first level (topic organization) consists of the problem of document organization that depends basically on the vocabulary. In this problem, each expected group of documents has its own common terms, so documents can be differentiated mainly by the vocabulary. The second level of semantic complexity (semantic organization) consists of the organization problem that cannot be solved by the vocabulary. It requires a deeper semantic knowledge, as the documents cannot be differentiated.

*BS-full* and *BS-topic* datasets correspond to topic organization problems, the first level of semantic complexity. It is expected that the documents are organized by sports and some sports have particular terms. For example, among the frequent words in Formula 1 documents are *grid*, *pole*, and *GP*, whereas *set*, *game*, and *match* are among the frequent words in Tennis documents. *BS-semantic* and *BS-topic-semantic* datasets correspond to semantic organization problems, the second level of semantic complexity. Vocabulary is not enough to differentiate a document that reports a victory of a Brazilian athlete from a document that reports a Brazilian defeat.

In order to measure the difficulty of each dataset, Sinoara et al. (2017) analyzed the compactness and separation of the known clusters using the silhouette width criterion. Figures 1 to 4 illustrate the silhouette width of each dataset. Small silhouette width (around 0) indicates that the document lies at a cluster border, near other clusters. We can note that the topic organization datasets (Figures 1 and 2) have average silhouette widths higher than the semantic organization datasets (Figures 3 and 4). Sinoara et al. (2017) discuss this subject.

Figure 1: *BS-full* - Average silhouette width: 0.08 (Sinoara et al., 2017)

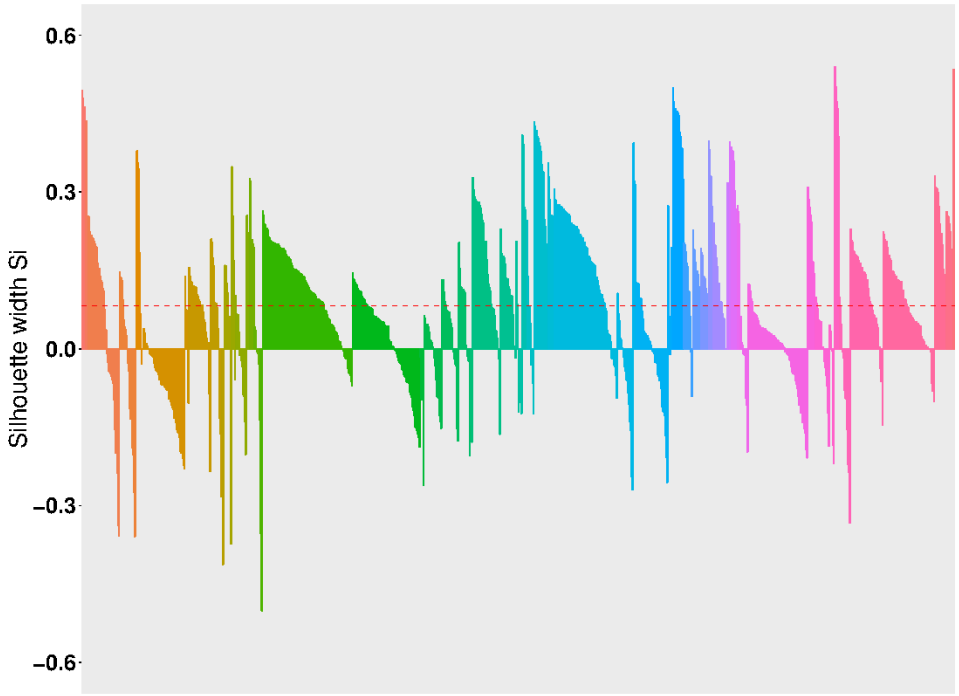



Figure 2: *BS-topic* - Average silhouette width: 0.20 (Sinoara et al., 2017)

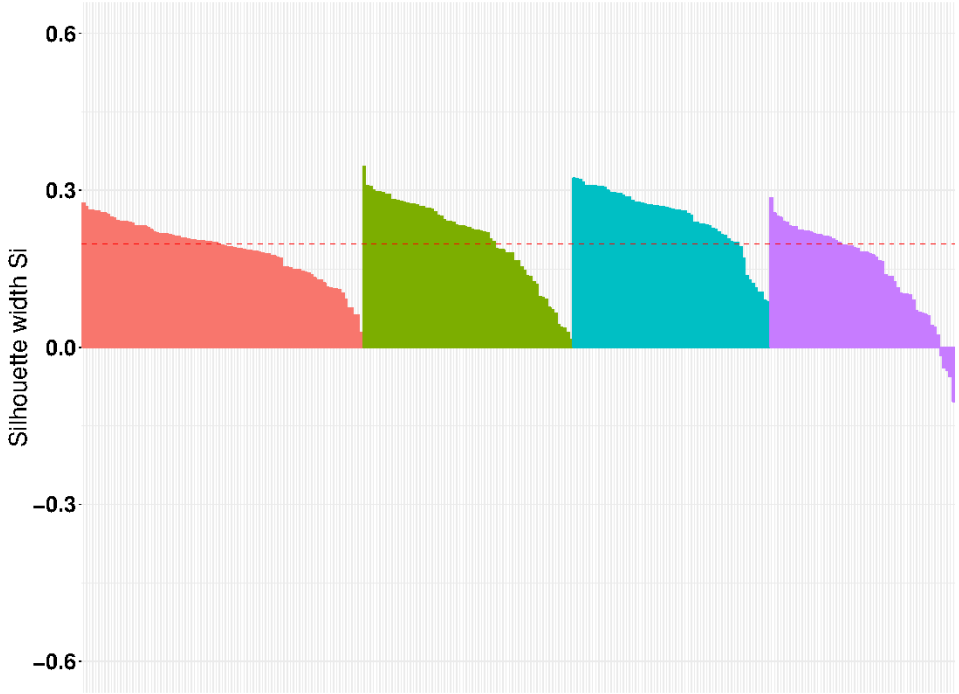


Figure 3: *BS-semantic* - Average silhouette width: 0.01 (Sinoara et al., 2017)

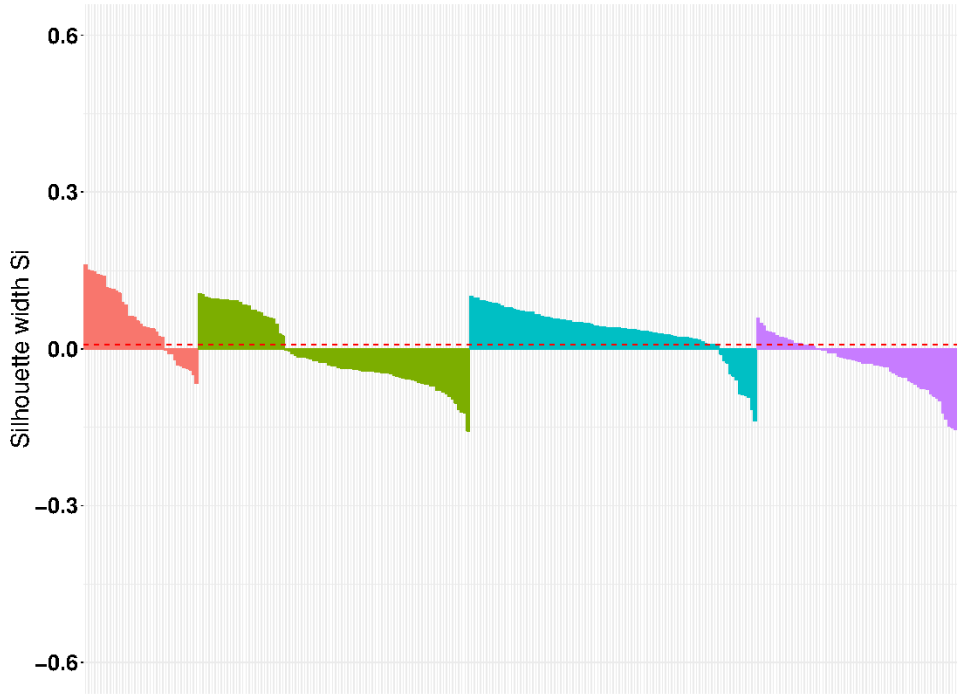
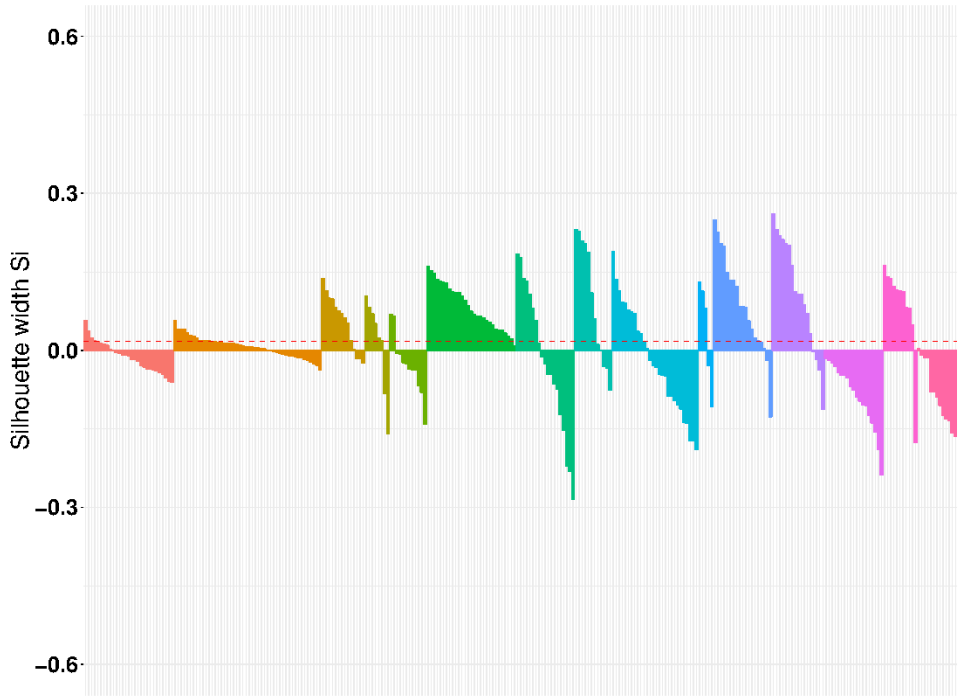


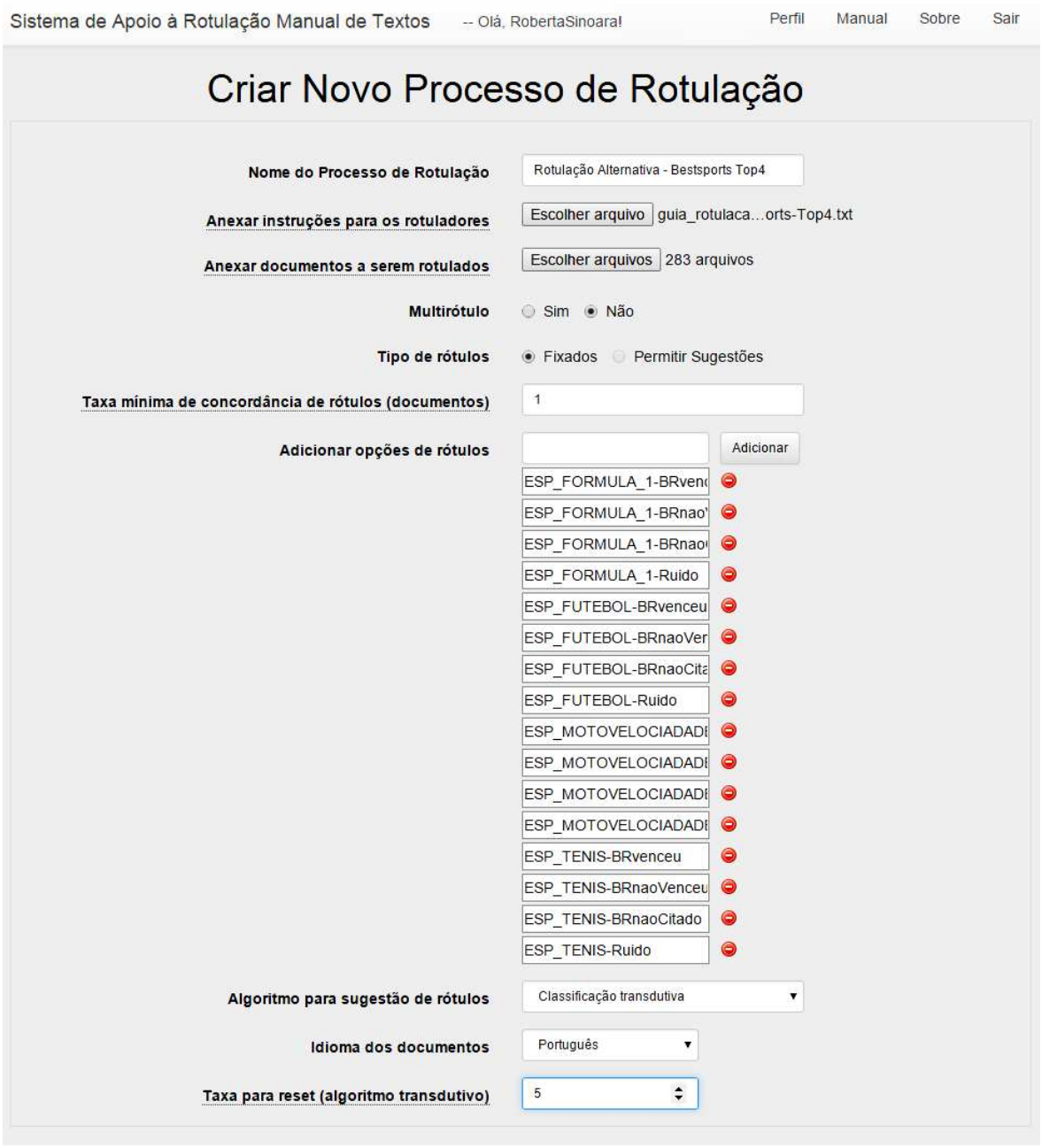

Figure 4: *BS-topic-semantic* - Average silhouette width: 0.02 (Sinoara et al., 2017)



# 4. Labeling process

The process of manual labeling the *BEST sports - Top 4* collection was supported by RotuLABIC[3] tool (Paravia et al., 2015). Figure 5 presents the configuration parameters set for the RotuLABIC labeling process. The process execution followed a labeling guide (written in Portuguese), which is presented in Figure 6. The objective of this process was to label *BEST sports - Top 4* documents according to the reported performance of Brazilian athletes.

Figure 5: RotuLABIC - Labeling process configuration




[3]RotuLABIC: `http://labic.icmc.usp.br/material/14`

Figure 6: *BEST sports - Top 4* - Labeling guide (in Portuguese)

GUIA PARA ROTULAÇÃO DE TEXTOS - BESTSPORTS TOP 4

Base de Textos: Bestsports - Top4
Total de documentos: 283

Essa é uma base de textos formada pela 4 classes com maior número de notícias da coleção Best sports:
- ESP_FORMULA_1: 91 notícias
- ESP_FUTEBOL: 68 notícias
- ESP_MOTOVELOCIADADE: 64 notícias
- ESP_TENIS: 60 notícias

O objetivo desse processo de rotulação é classificar os documentos em relação à quem ganhou a competição relatada na notícia, sendo que estamos interessados nos atletas brasileiros. Assim, as notícias devem ser classificadas de acordo com o esporte relatado (Formula 1, Futebol, Motovelocidade ou Tênis) e se há relato sobre a vitória de um atleta brasileiro.

Rótulos:

- ESP_FORMULA_1-BRvenceu
Caso piloto brasileiro tenha ficado entre os três primeiros colocados.
- ESP_FORMULA_1-BRnaoVenceu
Caso piloto brasileiro não tenha ficado entre os três primeiros colocados.
- ESP_FORMULA_1-BRnaoCitado
Caso nenhum piloto brasileiro tenha sido citado na notícia.
- ESP_FORMULA_1-NaoDefinido
Caso a notícia não relate uma etapa do campeonato.
- ESP_FUTEBOL-BRvenceu
Caso a equipe brasileira tenha vencido uma partida ou ficado entre os três primeiros colocados.
- ESP_FUTEBOL-BRnaoVenceu
Caso a equipe brasileira tenha perdido uma partida.
- ESP_FUTEBOL-BRnaoCitado
Caso a equipe brasileira não tenha sido citada na notícia.
- ESP_FUTEBOL-NaoDefinido
Caso a notícia não relate o resultado de uma partida ou campeonato.
- ESP_MOTOVELOCIDADE-BRvenceu
Caso piloto brasileiro tenha ficado entre os três primeiros colocados.
- ESP_MOTOVELOCIDADE-BRnaoVenceu
Caso piloto brasileiro não tenha ficado entre os três primeiros colocados.
- ESP_MOTOVELOCIDADE-BRnaoCitado
Caso nenhum piloto brasileiro tenha sido citado na notícia.
- ESP_MOTOVELOCIDADE-NaoDefinido
Caso a notícia não relate uma etapa do campeonato.
- ESP_TENIS–BRvenceu
Caso atleta brasileiro tenha vencido uma partida ou ficado entre os três primeiros colocados.
- ESP_TENIS–BRnaoVenceu
Caso atleta brasileiro não tenha vencido ou não tenha ficado entre os três primeiros colocados.
- ESP_TENIS–BRnaoCitado
Caso nenhum atleta brasileiro tenha sido citado na notícia.
- ESP_TENIS–NaoDefinido
Caso a notícia não relate uma partida ou campeonato.

Table 3 presents some specific details of each sports category and Table 4 presents the class distribution of *BEST sports - Top 4* collection, according to the classification of *BS-topic-semantic* dataset. It must be noted that the class label NaoDefinido (*"Not defined"*) was initially labeled as Ruido (*"Noise"*). After the labeling process, it was renamed to improve its label meaning.

Table 3: Specific details of each sports category

| Sports category | Notes |
|---|---|
| Fórmula 1 (Formula 1) | - Any podium position is considered a victory.<br>- Qualifying session results (grid position) are treated as competition results.<br>- Documents reporting season information and car launches are labeled as ESP_FORMULA_1-NaoDefinido.<br>- Documents reporting pre-season testings are labeled as ESP_FORMULA_1-NaoDefinido. |
| Futebol (Soccer) | - The focus is results of matches.<br>- Tournament rankings are not considered victory or defeat.<br>- Documents reporting ties of Brazilian team matches are labeled as ESP_FUTEBOL-NaoDefinido.<br>- Documents reporting FIFA *Ranking* are labeled as ESP_FUTEBOL-NaoDefinido. |
| Motovelocidade (MotoGP) | - Formula 1 notes also apply to MotoGP.<br>- Documents reporting provisional pole position are labeled as ESP_MOTOVELOCIDADE-NaoDefinido. |
| Tênis (Tennis) | - The focus is results of matches.<br>- Documents reporting both victory and defeat of a Brazilian athlete are labeled as ESP_TENIS–NaoDefinido. |

Table 4: Class distribution of *BEST sports - Top 4* collection

| Class label | # Docs |
|---|---|
| ESP_FORMULA_1-BRvenceu | 48 |
| ESP_FORMULA_1-BRnaoVenceu | 29 |
| ESP_FORMULA_1-BRnaoCitado | 0 |
| ESP_FORMULA_1-NaoDefinido | 14 |
| ESP_FUTEBOL-BRvenceu | 29 |
| ESP_FUTEBOL-BRnaoVenceu | 12 |
| ESP_FUTEBOL-BRnaoCitado | 8 |
| ESP_FUTEBOL-NaoDefinido | 19 |
| ESP_MOTOVELOCIDADE-BRvenceu | 5 |
| ESP_MOTOVELOCIDADE-BRnaoVenceu | 28 |
| ESP_MOTOVELOCIDADE-BRnaoCitado | 12 |
| ESP_MOTOVELOCIDADE-NaoDefinido | 19 |
| ESP_TENIS–BRvenceu | 11 |
| ESP_TENIS–BRnaoVenceu | 19 |
| ESP_TENIS–BRnaoCitado | 17 |
| ESP_TENIS–NaoDefinido | 13 |

# 5. Final remarks

In this technical report, we described the *BEST sports* collection and the four derived datasets. The document collection was collected and prepared to be used as benchmarking collection in text mining research. We created the datasets referring to problems of different semantic complexity levels. *BEST sports* documents are available at `http://sites.labic.icmc.usp.br/rsinoara/bestsports`. The *BEST sports* collection is provided for non-commercial and research purposes only. If you make use of this collection or any derivative of it, please, consider citing this technical report.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