Complex network in text mining

Alneu de Andrade Lopes and Alan Valejo

University of São Paulo (campus at São Carlos)

Códigos

Github

https://github.com/alanvalejo/icmc2019bigdata

Laboratório

Algoritmos

- IMBHN (supervisionado)
- TPBG (semi-supervisionado)
- PBG (não supervisionado)

Ferramentas

- Python
- Scikit Learn
- NLTK

Tarefas

- Kfold e supervisionado
- Semi-supervisionado e número de rótulos
- Não supervisionado, pré-processamento e tópicos

Dados

- Sintéticos
- Reais

Tipos de dados

- Arff
- Ncol
- Coleções de documentos

BNOC - Dados sintéticos

Valejo, Alan and Goes, F. and Romanetto, L. M. and Oliveira, Maria C. F. and Lopes, A. A., A benchmarking tool for the generation of bipartite network models with overlapping communities, in *Knowledge and information systems*, accepted paper, 2019

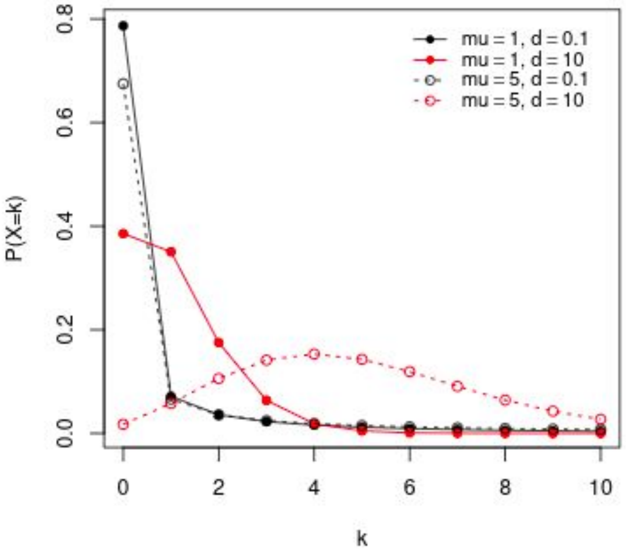
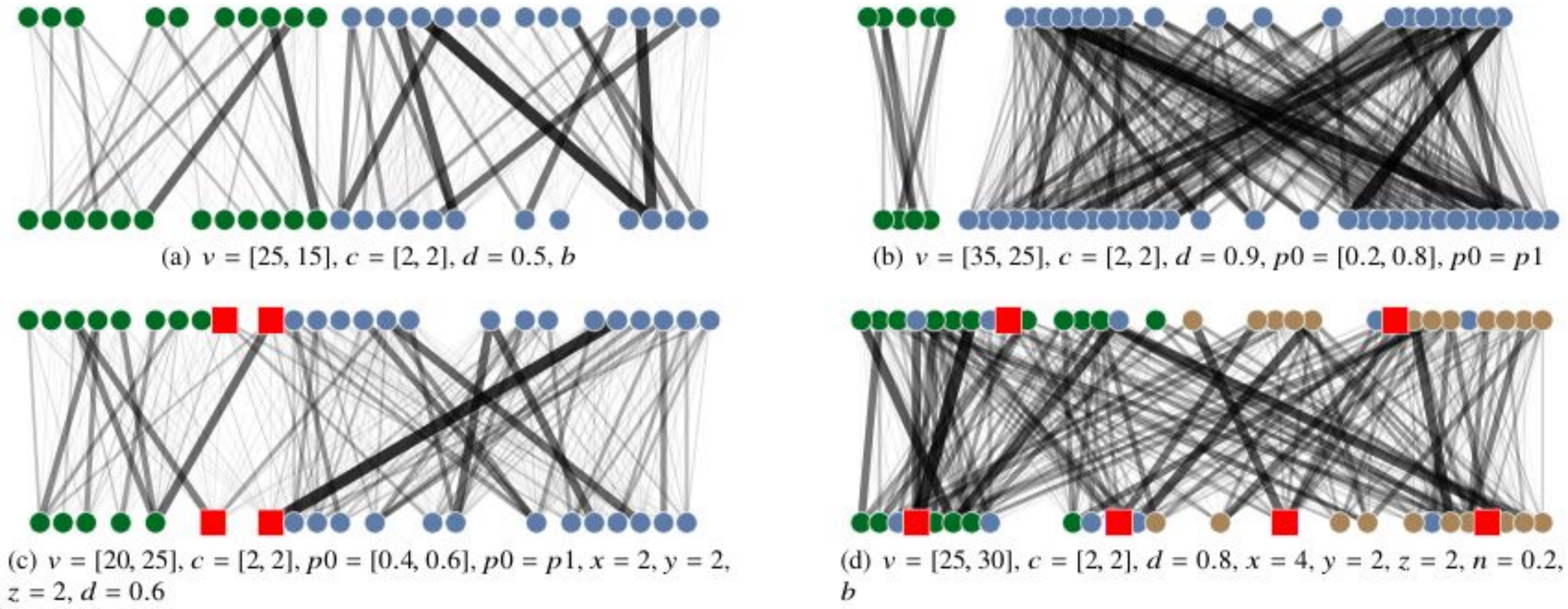


Fig. 1 Negative binomial distribution for distinct values of parameters *mu* and *d*.

Uma distribuição de probabilidade discreta que representa o número de possíveis falhas em uma sequência de ensaios de Bernoulli antes de atingir um número alvo de sucessos.

BNOC - Dados sintéticos



(a) $v = [25, 15]$, $c = [2, 2]$, $d = 0.5$, b

(b) $v = [35, 25]$, $c = [2, 2]$, $d = 0.9$, $p0 = [0.2, 0.8]$, $p0 = p1$

(c) $v = [20, 25]$, $c = [2, 2]$, $p0 = [0.4, 0.6]$, $p0 = p1$, $x = 2$, $y = 2$, $z = 2$, $d = 0.6$

(d) $v = [25, 30]$, $c = [2, 2]$, $d = 0.8$, $x = 4$, $y = 2$, $z = 2$, $n = 0.2$, b

BNOC - Dados sintéticos

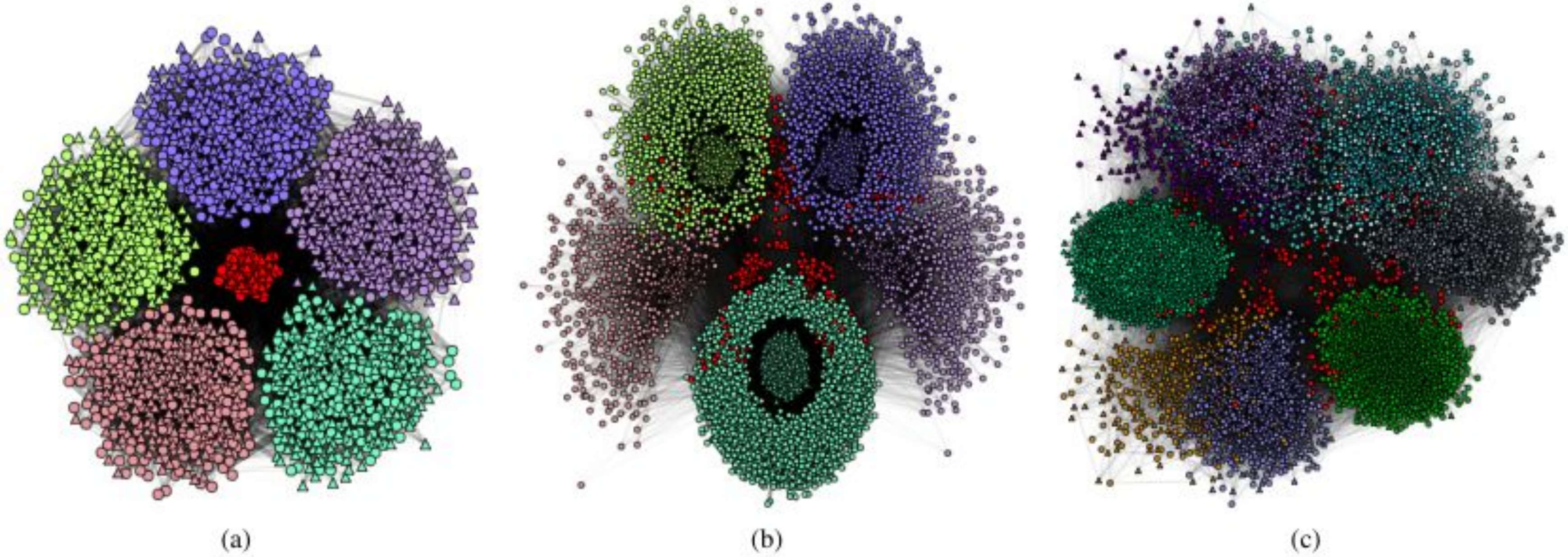
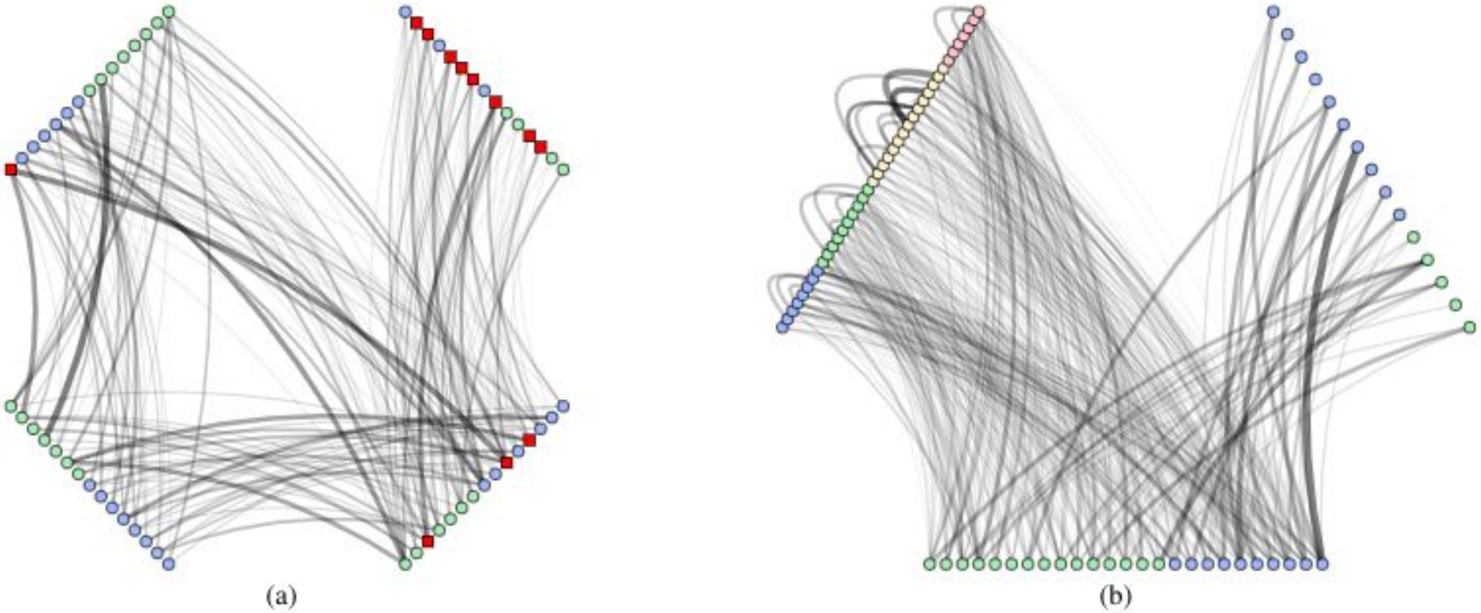


Fig. 7 Bipartite networks generated with BNOC illustrating the effect of varying parameter z, which controls the degree of community overlapping. Red markers depict overlapping vertices, whereas other colors indicate the assigned communities of the non-overlapping vertices. (a) a network built with five communities ($c = [5, 5]$) and $z = 5$ (strong overlapping); (b) a network built with $c = [5, 5]$, $z = 3$, and $x = y = 80$; (c) a network built with $c = [10, 10]$, $z = 2$, and $x = y = 150$.

BNOC - Dados sintéticos



(a)

(b)

Fig. 20 Heterogeneous networks generated with HNOC presenting distinct topological structures and properties: red squares depict overlapping vertices and colored circles indicate non-overlapping vertices and their assigned community; line widths reflect the corresponding edge weights. (a) illustrates a 4-partite network with $v = [15, 15, 15, 15]$, $e = [(0, 1), (1, 2), (2, 3), (3, 1)]$ and $x = [8, 3, 0, 1]$; (b) depicts a heterogeneous network obtained with settings $v = [40, 25, 15]$, $e = [(0, 1), (1, 2), (2, 2)]$, $c = [2, 2, 4]$, and $d = [0.45, 0.85, 0.15, 0.15]$. The network drawings were obtained based on the technique described by Uslu and Mehler (2018).

Coleções de texto reais

http://conteudo.icmc.usp.br/CMS/Arquivos/arquivos_enviados/BIBLIOTECA_113_RT_395.pdf

CSTR

- Composta por resumos e relatórios técnicos publicados no Departamento de Ciência da Computação da Universidade de Rochester, de 1991 a 2007. Os documentos pertencem a 4 áreas: Processamento de Linguagem Natural, Robótica/Visão, Sistemas e Teoria

Documents	Terms	Terms	Systems	Theory	Robotics	ArtificialIntelligence
299	1726	54.27	25	46	100	128

SyskillWebert

- Composta por páginas da web com assuntos variados, desde bandas e músicas até textos da área de biomedicina.

Documents	Terms	Terms	Bands	Sheep	Goats	Biomedical
334	4340	93.16	61	65	71	137

Formatos de dados

.ncol

```
vertice    vertice    peso
vertice    vertice    peso
vertice    vertice    peso
vertice    vertice    peso
……..…
```

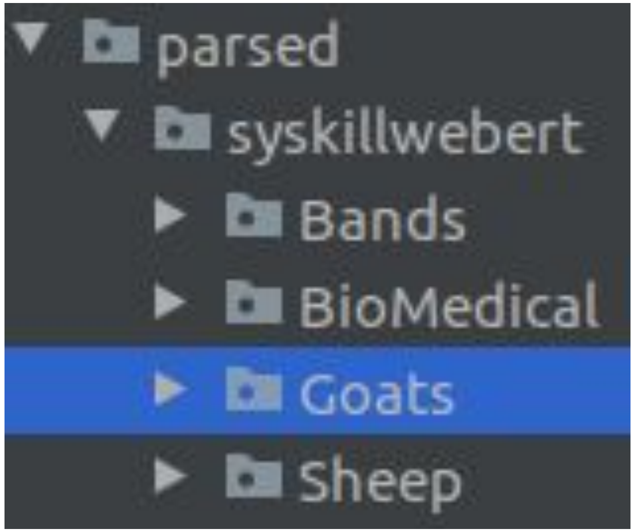
Formatos de dados

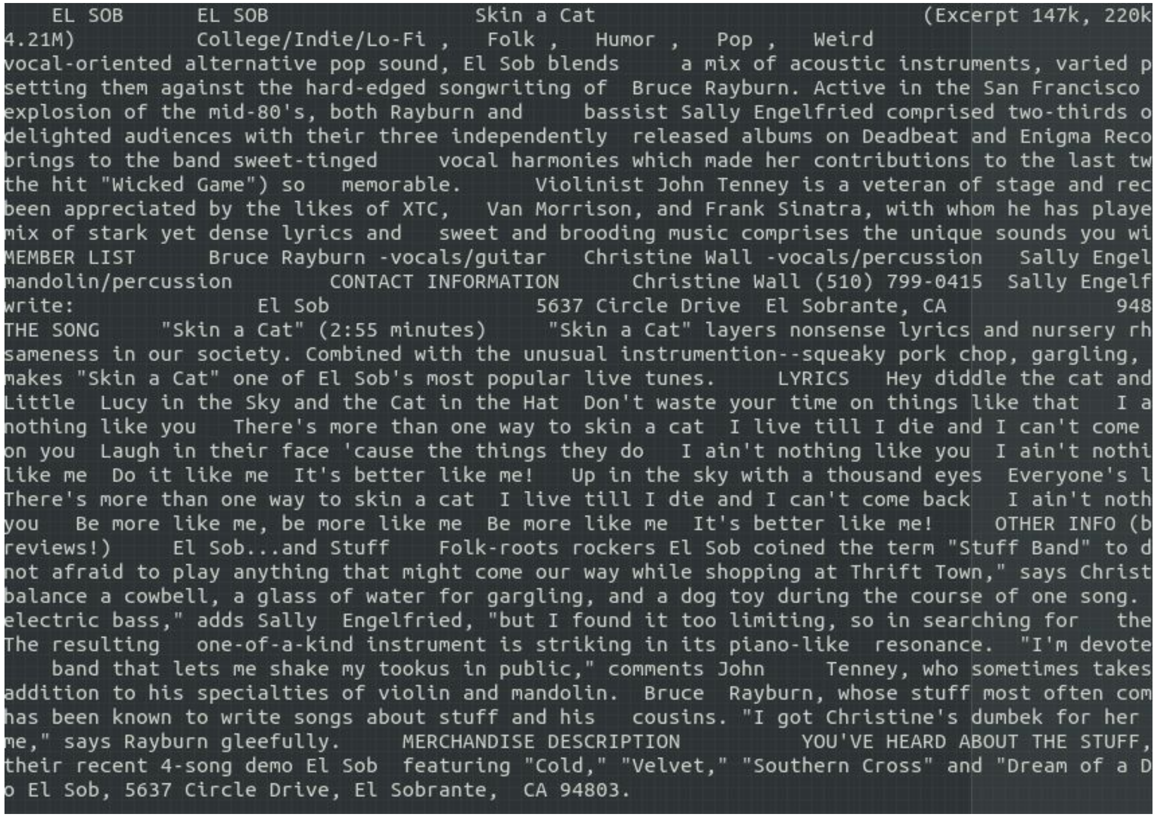
.arff (weka)

```
@relation CSTR

@attribute plastic numeric
………
@attribute class_atr {Theory,ArtificiallIntelligence,Robotics,Systems}

@data
0,1,0, …, Theory
3,0,0, …, ArtificiallIntelligence
...
```

Formatos de dados

texto





```
    EL SOB      EL SOB                 Skin a Cat                            (Excerpt 147k, 220k
4.21M)          College/Indie/Lo-Fi ,   Folk ,   Humor ,   Pop ,   Weird
vocal-oriented alternative pop sound, El Sob blends     a mix of acoustic instruments, varied p
setting them against the hard-edged songwriting of  Bruce Rayburn. Active in the San Francisco
explosion of the mid-80's, both Rayburn and     bassist Sally Engelfried comprised two-thirds o
delighted audiences with their three independently  released albums on Deadbeat and Enigma Reco
brings to the band sweet-tinged     vocal harmonies which made her contributions to the last tw
the hit "Wicked Game") so   memorable.      Violinist John Tenney is a veteran of stage and rec
been appreciated by the likes of XTC,   Van Morrison, and Frank Sinatra, with whom he has playe
mix of stark yet dense lyrics and   sweet and brooding music comprises the unique sounds you wi
MEMBER LIST      Bruce Rayburn -vocals/guitar   Christine Wall -vocals/percussion   Sally Engel
mandolin/percussion        CONTACT INFORMATION      Christine Wall (510) 799-0415  Sally Engelf
write:               El Sob                5637 Circle Drive  El Sobrante, CA             948
THE SONG     "Skin a Cat" (2:55 minutes)     "Skin a Cat" layers nonsense lyrics and nursery rh
sameness in our society. Combined with the unusual instrumention--squeaky pork chop, gargling,
makes "Skin a Cat" one of El Sob's most popular live tunes.     LYRICS   Hey diddle the cat and
Little  Lucy in the Sky and the Cat in the Hat  Don't waste your time on things like that   I a
nothing like you   There's more than one way to skin a cat  I live till I die and I can't come
on you  Laugh in their face 'cause the things they do   I ain't nothing like you  I ain't nothi
like me  Do it like me  It's better like me!   Up in the sky with a thousand eyes  Everyone's l
There's more than one way to skin a cat  I live till I die and I can't come back   I ain't noth
you   Be more like me, be more like me  Be more like me  It's better like me!     OTHER INFO (b
reviews!)     El Sob...and Stuff    Folk-roots rockers El Sob coined the term "Stuff Band" to d
not afraid to play anything that might come our way while shopping at Thrift Town," says Christ
balance a cowbell, a glass of water for gargling, and a dog toy during the course of one song.
electric bass," adds Sally  Engelfried, "but I found it too limiting, so in searching for   the
The resulting   one-of-a-kind instrument is striking in its piano-like  resonance.  "I'm devote
    band that lets me shake my tookus in public," comments John     Tenney, who sometimes takes
addition to his specialties of violin and mandolin.  Bruce  Rayburn, whose stuff most often com
has been known to write songs about stuff and his   cousins. "I got Christine's dumbek for her
me," says Rayburn gleefully.     MERCHANDISE DESCRIPTION         YOU'VE HEARD ABOUT THE STUFF,
their recent 4-song demo El Sob  featuring "Cold," "Velvet," "Southern Cross" and "Dream of a D
o El Sob, 5637 Circle Drive, El Sobrante,  CA 94803.
```

Instalação

Máquina virtual “Matemática”

Terminal Anaconda

```
$ pip install unidecode
$ pip install pypdf2
$ pip install pandas
$ pip install scikit-learn
$ pip install nltk
$ python
>> import nltk
>> nltk.download('stopwords')
CTRl+d
```

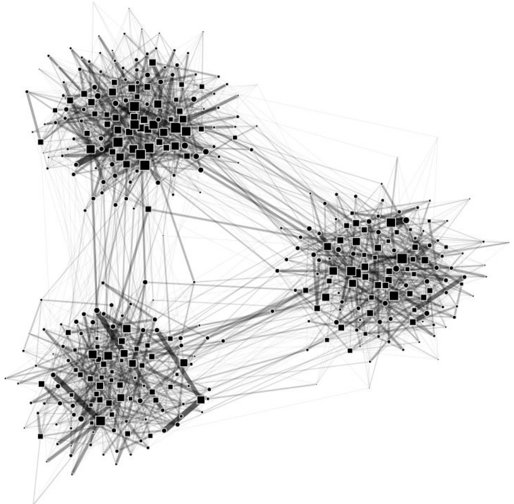
Experimento 1

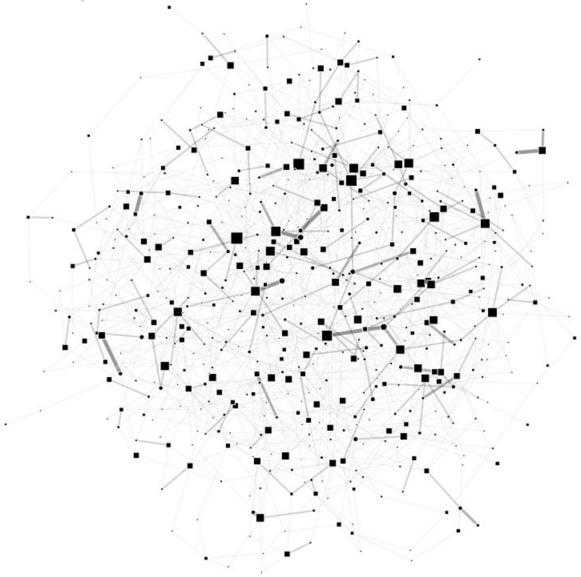
Dados sintéticos usando o BNOC

- Simular redes bipartidas sintéticas de documentos e termos, com características topológicas simples ou complexas

Scripts

- `$ python bnoc.py -cnf input/input_document_term_easy.json`
- `$ python bnoc.py -cnf input/input_document_term_hard.json`





Experimento 2

Problema supervisionado: Classificação de documentos

- IMBHN

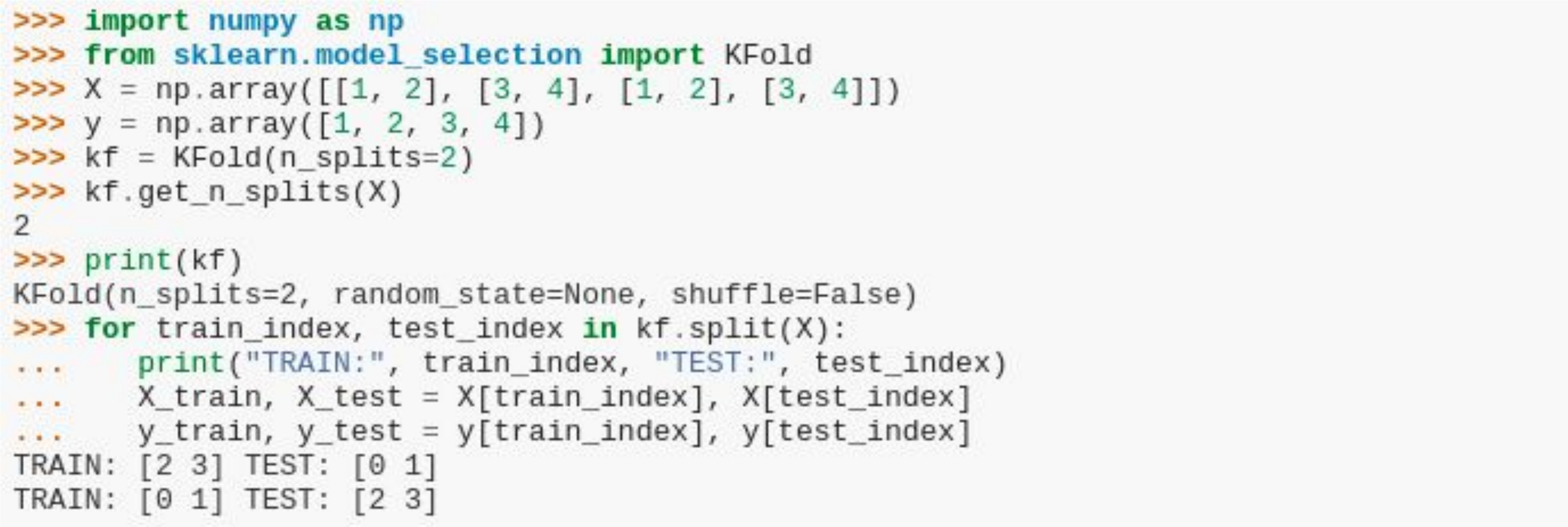
Conceitos

- kfold
- sklearn

Script

- $ python imbhn-bnoc-supervised.py

Experimento 2



```
>>> import numpy as np
>>> from sklearn.model_selection import KFold
>>> X = np.array([[1, 2], [3, 4], [1, 2], [3, 4]])
>>> y = np.array([1, 2, 3, 4])
>>> kf = KFold(n_splits=2)
>>> kf.get_n_splits(X)
2
>>> print(kf)
KFold(n_splits=2, random_state=None, shuffle=False)
>>> for train_index, test_index in kf.split(X):
...    print("TRAIN:", train_index, "TEST:", test_index)
...    X_train, X_test = X[train_index], X[test_index]
...    y_train, y_test = y[train_index], y[test_index]
TRAIN: [2 3] TEST: [0 1]
TRAIN: [0 1] TEST: [2 3]
```

Experimento 3

Problema semi-supervisionado

- TPBG

Conceitos

- Quantidade de dados rotulados
- scipy
- sklearn

Scripts

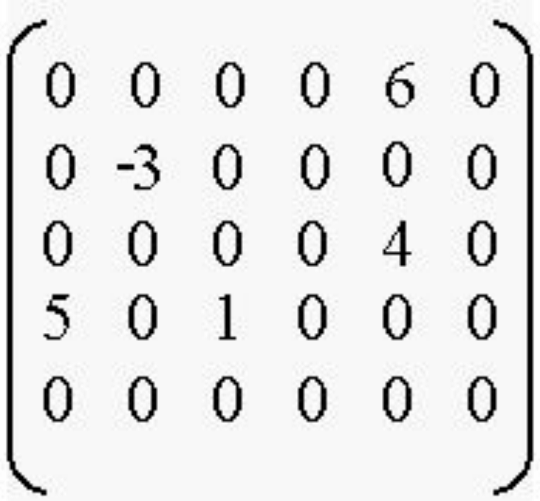
- $ python pbg-bnoc-semi-supervised.py (base sintética)
- $ python pbg-cstr-semi-supervised.py (base real)

Experimento 3

- Pré-processamento
  - Transformar .ncol em matriz esparsa

.ncol

```
vertice   vertice   peso
vertice   vertice   peso
vertice   vertice   peso
vertice   vertice   peso
………
```



$$\begin{pmatrix} 0 & 0 & 0 & 0 & 6 & 0 \\ 0 & -3 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 4 & 0 \\ 5 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Experimento 4

Problema não supervisionado: Encontrar tópicos em coleções de documentos

- PBG
- LDA

Conceitos

- Pré-processamento
- NLTK
- sklearn

Scripts

- $ python pbg-syskillwebert-unsupervised.py

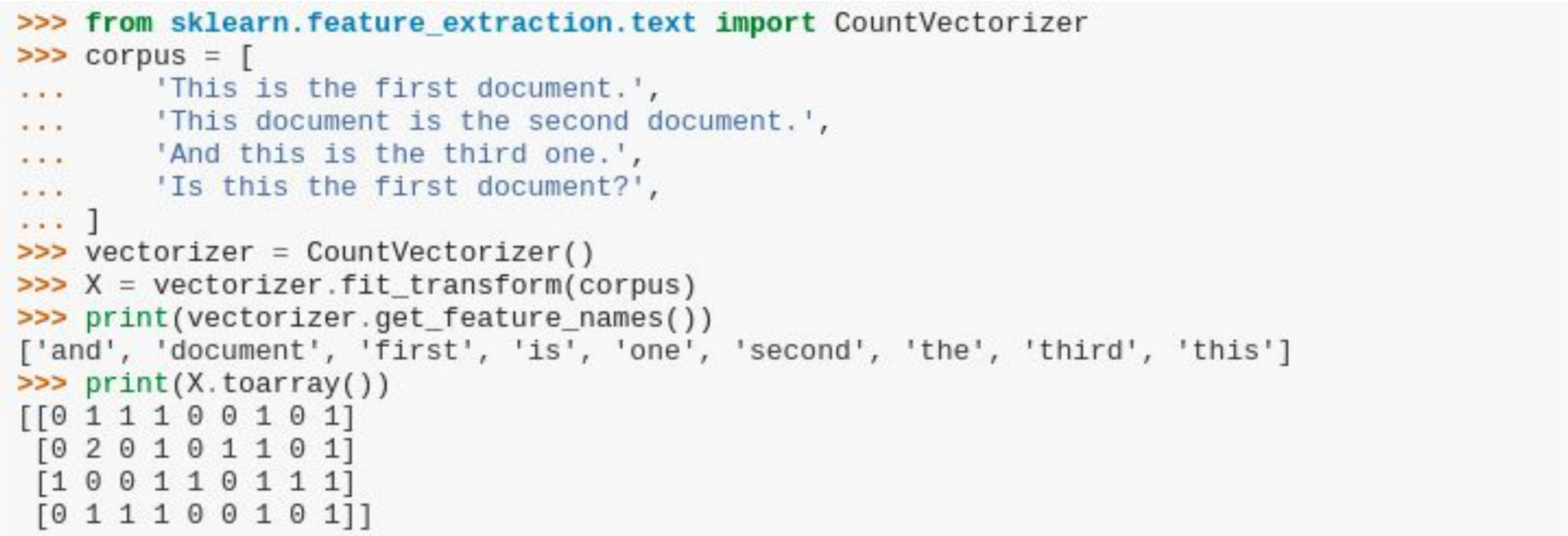
Experimento 4

```
# Script: pbg-syskillwebert-unsupervised.py, linha 18
d = l.from_files('input/parsed/syskillwebert')
d = l.from_files('C:\\Users\\ICMC\\Downloads\\icmc2019bigdata-master\\pbg\\input\\parsed\\syskillwebert')
```

Pré-processamento (NLTK e sklearn)

- Remover stopwords (‘and’, ‘,’ ...)
- Stemmers (remover plurais, gênero ..., manter apenas o radical)
- Regular expression operations
- Rede bipartida
  - CountVectorize: Cria um vetor de vocabulário e a frenquência de cada palavra em cada documento

Experimento 4



```
>>> from sklearn.feature_extraction.text import CountVectorizer
>>> corpus = [
...     'This is the first document.',
...     'This document is the second document.',
...     'And this is the third one.',
...     'Is this the first document?',
... ]
>>> vectorizer = CountVectorizer()
>>> X = vectorizer.fit_transform(corpus)
>>> print(vectorizer.get_feature_names())
['and', 'document', 'first', 'is', 'one', 'second', 'the', 'third', 'this']
>>> print(X.toarray())
[[0 1 1 1 0 0 1 0 1]
 [0 2 0 1 0 1 1 0 1]
 [1 0 0 1 1 0 1 1 1]
 [0 1 1 1 0 0 1 0 1]]
```

Thank you!