

ΠΑΝΕΠΙΣΤΗΜΙΟ ΜΑΚΕΔΟΝΙΑΣ  
ΤΜΗΜΑ ΕΦΑΡΜΟΣΜΕΝΗΣ ΠΛΗΡΟΦΟΡΙΚΗΣ  
Π.Μ.Σ  
«Υπολογιστικές Μέθοδοι και Εφαρμογές»



---

ΠΑΡΟΥΣΙΑΣΗ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ

**“Design and development of a system based on short questions for retrieving relevant documents that express opinion.”**

Κοζάρη Γεωργία, Μαθηματικός  
Α.Μ: mai18068

Επόπτρια: Επίκουρη καθηγήτρια Κολωνiάρη Γεωργία

Οκτώβριος, 2019



# CONTENTS

---

1. **Introduction**
2. **Dissertation's Purpose**
3. **Methodological consideration**
4. **Experiments**
5. **Results**
6. **Conclusion**



---

**1.**

# **Introduction**

# Opinion mining and the enquiry of information retrieval systems

**Opinion mining** : Given a set of evaluative text documents  $D$  that contain opinions (or sentiments) about an entity (e.g. item/topic/person/product or service), opinion mining aims to extract aspects (e.g. properties or attributes) of the entity that have been commented on in each document  $d \in D$  and to determine whether the comments are positive, negative or neutral (**Bakhatawar and Farouque, 2012**).

## Levels of Opinion Mining :

1. Document Level
2. Sentence Level
3. Aspect-Feature Level

## Applications of opinion mining :

- Marketing
- Business
- Politics
- Shopping
- Entertainment

# Opinion mining and the enquiry of information retrieval systems



## Information Retrieval (IR) :

- The most interesting part of IR is the new challenges and the motivation of researchers to look for intelligent information retrieval systems.
- These systems search and/or filter information automatically based on some higher level of understanding.



---

2.

## Dissertation' s purpose



# Dissertation's purpose

---

- Design and development of an intelligent information retrieval system that will be based on short questions-keywords and its aim will be to retrieve relevant documents that express opinion.
- It will generate results, ranked by certain criteria (e.g. relevance) and corresponding to user's query.
- Expansion of the user's query in synonyms, hypernyms, and hyponyms by using thesauruses, while the calculation of term frequency-inverse document frequency score in order to find the most relevant documents were essential for the design and evaluation of the system.

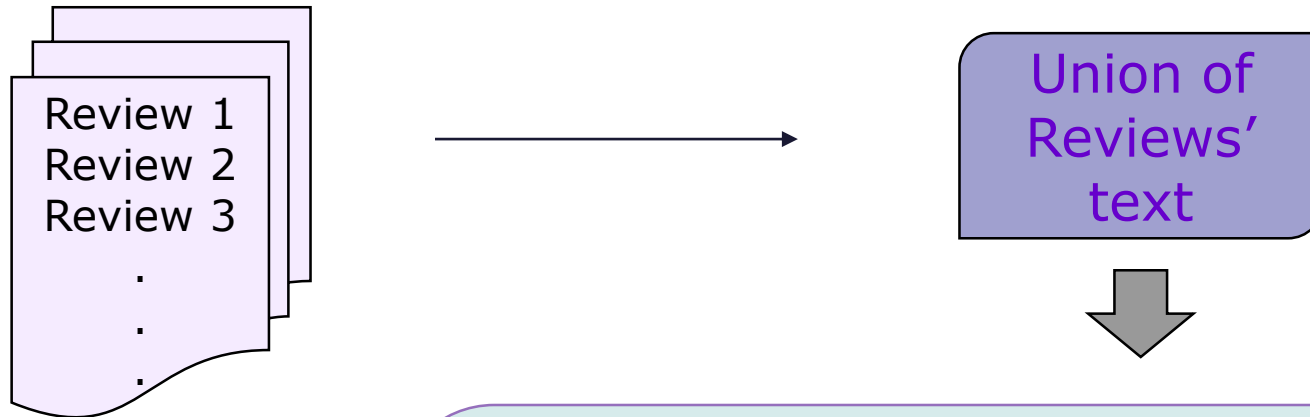


---

**3.**

## **Methodological Considerations**

## 3.1 Data and user's query Pre-processing



### **PRE-PROCESSING OF DATA**

- Step 1 : Tokenization
- Step 2 : Normalization
- Step 3 : Stopwords Removal
- Step 4 : Punctuation Removal
- Step 5 : Apostrophe Removal
- Step 6 : Lemmatization
- Step 7 : POS Tagging

# Data Pre-processing

## EXAMPLE :

Union of reviews' text →

What I love about this wine is the fruitiness, and the medium body that allows it to go with just about any dish that you would traditionally pair with a red wine....

## STEP 1 : TOKENIZATION

What	I	love	about	this
wine	is	the	fruitiness	,
and	the	medium	body	that

## STEP 2 : NORMALIZATION

what	i	love	about	this
wine	is	the	fruitiness	,
and	the	medium	body	that

# Data Pre-processing

## STEP 3 : STOPWORDS REMOVAL

love wine fruitiness ,  
medium body

## STEP 4 : PUNCTUATION REMOVAL

love wine fruitiness  
medium body

## STEP 5 : APOSTROPHE REMOVAL

don't → dont

## STEP 6 : LEMMATIZATION

dishes → dish

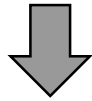
## STEP 7 : POS TAGGING

love VB wine NN fruitiness JJ  
traditionally RB red JJ

# Pre-processing of user's query

## USER'S QUERY

Please enter your question!



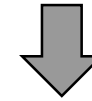
### PRE-PROCESSING OF USER'S QUERY

Step 1 : Tokenization  
Step 2 : Normalization  
Step 3 : Stopwords  
Removal  
Step 4 : Punctuation  
Removal  
Step 5 : Apostrophe  
Removal  
Step 6 : Lemmatization

“Noise”  
Removal

## EXAMPLE

A bottle of good and red wine!



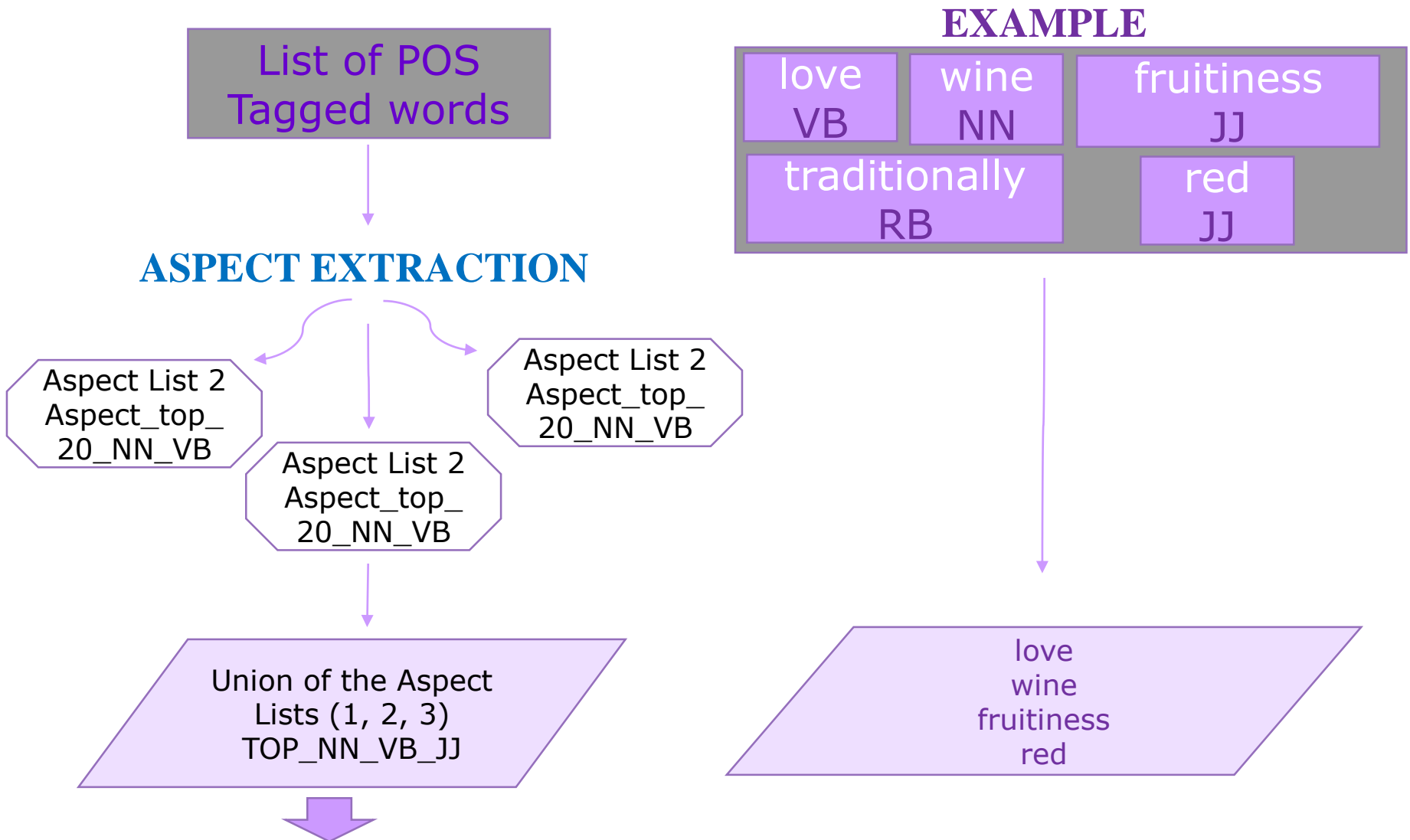
A bottle of good and  
red wine !



STEPS 2-6

bottle good red wine

## 3.2 Extraction of aspect words and expansion of them to thesauri



## Expansion of aspect words to thesauri

Union of the Aspect  
Lists (1, 2, 3)  
TOP\_NN\_VB\_JJ



THESAURI  
Synonyms-Hypernyms-  
Hyponyms

A lot of synonyms, hypernyms, and hyponyms of the aspect words have been included in the initial data and thus were also semantic words of the information retrieving! They were essential for the query's expansion!

**wine**

Synonyms

vino, wine-colored, ...

Hypernyms

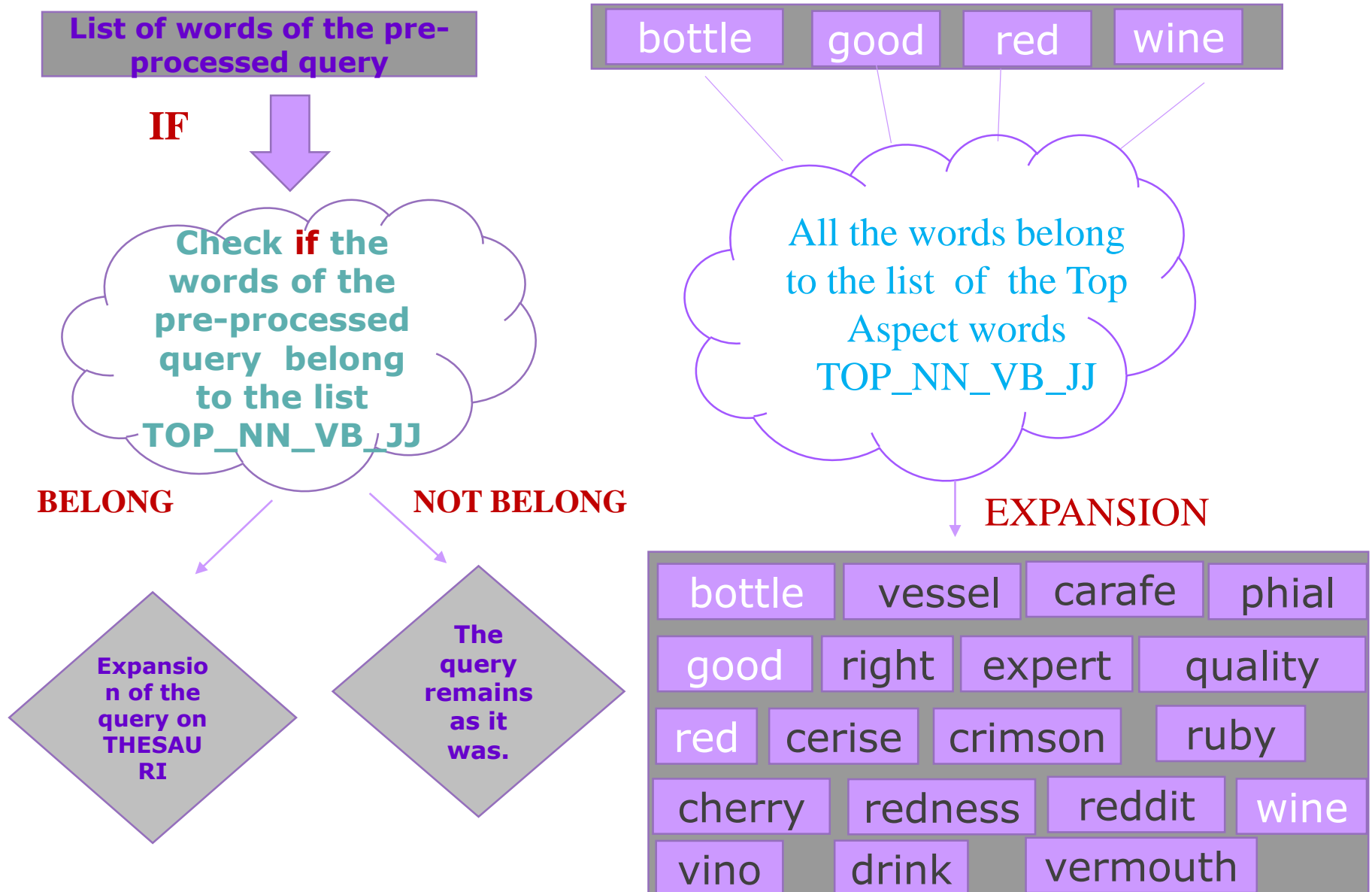
alcohol, drink, regale, ...

Hyponyms

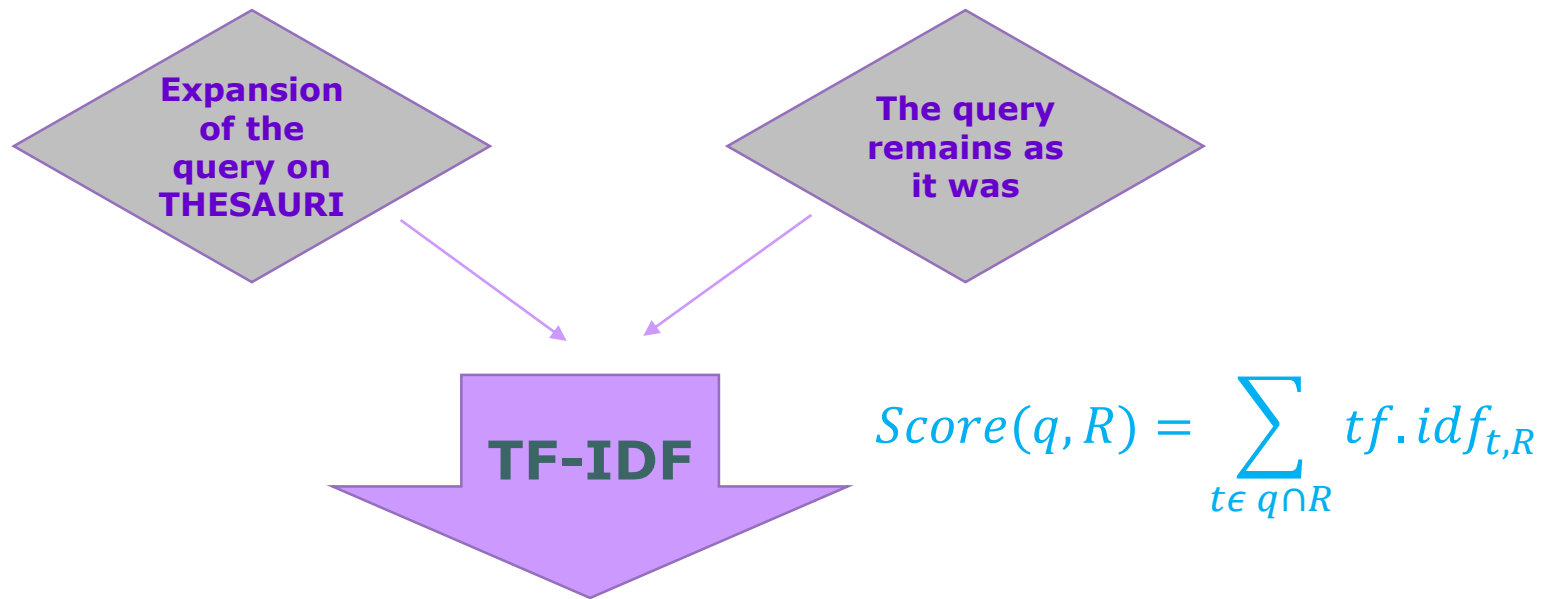
vermouth, vintage,  
bordeaux, ...

### 3.3 Query's expansion based on Thesauri

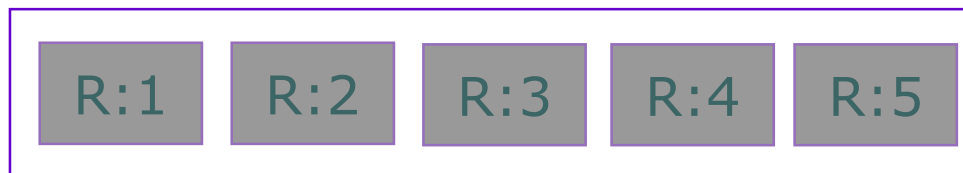
#### EXAMPLE



### 3.4 Connection between user's query and the most relevant documents



Five most relevant reviews!





---

# 4. Experiments

Experiment's Name	User's Query	Reviews
$A_1$	"A bottle of good wine!"	<i>total_A</i>
$A_2$	"A bottle of good and red wine!"	<i>total_A</i>
$A_3$	"A bottle of good and sweet wine!"	<i>total_A</i>
$A_4$	"A bottle of good, red, and sweet wine!"	<i>total_A</i>
$A_5$	"A bottle of cheap, red, and sweet wine!"	<i>total_A</i>
$A_6$	"A bottle of good, cheap, red, and sweet wine!"	<i>total_A</i>
$A_7$	"A bottle of good, cheap, white, and dry wine!"	<i>total_A</i>
$A_8$	"What i have to choose for a pasta menu?"	<i>total_A</i>
$A_9$	"What i have to choose for menu with many different cheeses?"	<i>total_A</i>
$A_{10}$	"What i have to choose for a sushi menu?"	<i>total_A</i>
$A_{11}$	"What i have to choose for menu with meat ?"	<i>total_A</i>
$A_{12}$	"What i have to choose for menu with fish?"	<i>total_A</i>
$A_{13}$	"A champagne for the celebration!"	<i>total_A</i>

$A_{14}$	"A bottle of Cabernet!"	<i>total_A</i>
$A_{15}$	"What about a Sauvignon Blanc?"	<i>total_A</i>
$A_{16}$	"A bottle of good wine!"	<i>part_A_1</i>
$A_{17}$	"A bottle of good wine!"	<i>part_A_2</i>
$A_{18}$	"A bottle of good wine!"	<i>part_A_a</i>
$A_{19}$	"A bottle of good wine!"	<i>part_A_b</i>
$A_{20}$	"A bottle of good wine!"	<i>part_A_c</i>
$A_{21}$	"A bottle of good wine!"	<i>part_A_d</i>
$A_{22}$	"A bottle of good, cheap, red, and sweet wine!"	<i>part_A_1</i>
$A_{23}$	"A bottle of good, cheap, red, and sweet wine!"	<i>part_A_2</i>
$A_{24}$	"A bottle of good, cheap, white, and dry wine!"	<i>part_A_1</i>
$A_{25}$	"A bottle of good, cheap, white, and dry wine!"	<i>part_A_2</i>

Table 1 : Experiments of the dataset of wine reviews.



# **5.**

## **Results**

## 5.1 Results of data pre-processing

Experiment	Reviews	Top_20 words before pre-processing (b.p)	Top_20 words after pre-processing (a.p)	Number of words of the union of reviews (b.p) and (a.p)
$A_1 - A_{15}$	<i>total_A</i>	[ ' ', ' ', 'a', 'the', 'I', 'and', 'wine', 'to', 'it', 'is', 'of', 'this', '!', 'with', 'for', 'was', 'in', 'that', 'my', 'not' ]	[ 'wine', 'taste', 'bottle', 'win', 'like', 'great', 'good', 'love', 'try', 'buy', 'drink', 'sweet', 'enjoy', 'red', 'flavor', 'price', 'well', 'really', 'order', 'gift' ]	(b.p)=155.316 (a.p)=66.899
$A_{16}, A_{22}, A_{24}$	<i>part_A_1</i>	[ ' ', ' ', 'a', 'I', 'the', 'and', 'wine', 'it', 'to', 'is', 'of', 'this', 'with', '!', 'for', 'that', 'in', 'was', 'but', 'not' ]	[ 'wine', 'taste', 'like', 'bottle', 'win', 'great', 'good', 'try', 'love', 'buy', 'drink', 'sweet', 'red', 'flavor', 'enjoy', 'price', 'well', 'smooth', 'go', 'make' ]	(b.p)=85.647 (a.p)=37.046
$A_{17}, A_{23}, A_{25}$	<i>part_A_2</i>	[ ' ', ' ', 'the', 'a', 'I', 'and', 'to', 'wine', 'of', 'is', 'it', 'this', '!', 'with', 'for', 'was', 'in', 'that', 'my', 'not' ]	[ 'wine', 'great', 'win', 'taste', 'bottle', 'love', 'like', 'good', 'buy', 'try', 'enjoy', 'drink', 'gift', 'red', 'pinot', 'really', 'order', 'sweet', 'flavor', 'price' ]	(b.p)=68.754 (a.p)=29.853
$A_{18}$	<i>part_A_a</i>	[ ' ', ' ', 'a', 'I', 'the', 'and', 'wine', 'it', 'to', 'is', 'of', 'this', 'with', 'for', '!', 'that', 'in', 'was', 'you', 'not' ]	[ 'wine', 'taste', 'like', 'bottle', 'win', 'good', 'try', 'drink', 'sweet', 'great', 'buy', 'love', 'red', 'price', 'flavor', 'enjoy', 'serve', 'go', 'well', 'smooth' ]	(b.p)=47.712 (a.p)=20.455

A <sub>19</sub>	part_A_b	[',', ',', 'a', 'the', 'I', 'and', 'wine', 'to', 'it', 'is', 'of', 'this', 'p', 'with', 'for', 'in', 'was', 'that', 'but', 'not']	['wine', 'taste', 'bot- tle', 'like', 'great', 'love', 'win', 'good', 'buy', 'try', 'sweet', 'drink', 'flavor', 'enjoy', 'red', 'well', 'really', 'price', 'recommend', 'smooth']	(b.p)=37.984 (a.p)=16.614
A <sub>20</sub>	part_A_c	[',', ',', 'a', 'the', 'I', 'and', 'wine', 'to', 'of', 'is', 'it', '!', 'this', 'with', 'for', 'was', 'in', 'that', 'my', 'but']	['wine', 'great', 'win', 'taste', 'like', 'bottle', 'love', 'good', 'buy', 'try', 'pinot', 'enjoy', 'drink', 'flavor', 'red', 'gift', 'nice', 'give', 're- ally', 'm']	(b.p)=35.762 (a.p)=15.634
A <sub>21</sub>	part_A_d	[',', ',', 'the', 'a', 'I', 'and', 'to', 'wine', 'of', 'it', 'is', 'this', '!', 'for', 'with', 'was', 'in', 'that', 'have', 'my']	['wine', 'win', 'great', 'taste', 'bottle', 'good', 'love', 'like', 'buy', 'try', 'enjoy', 'order', 'gift', 'foxen', 'drink', '34', 'price', 'really', 'red', 'sweet']	(b.p)=32.943 (a.p)=14.196

Table 2 : Results of the pre-processing of wine reviews.

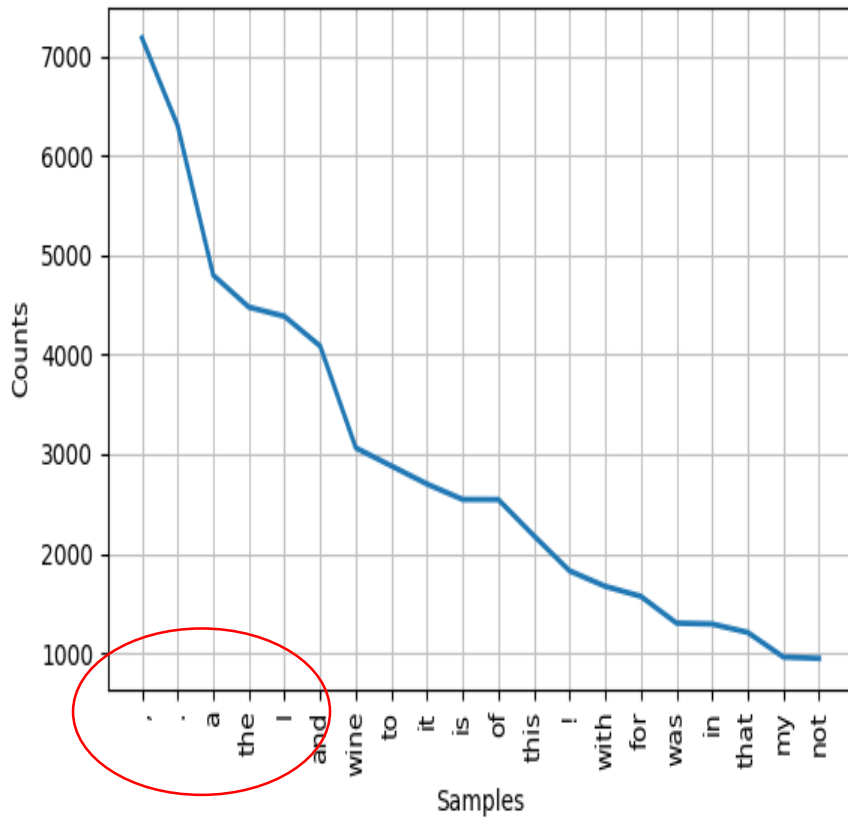


Figure 1 : Twenty most frequent words of the first fifteen experiments of wine reviews before preprocessing.

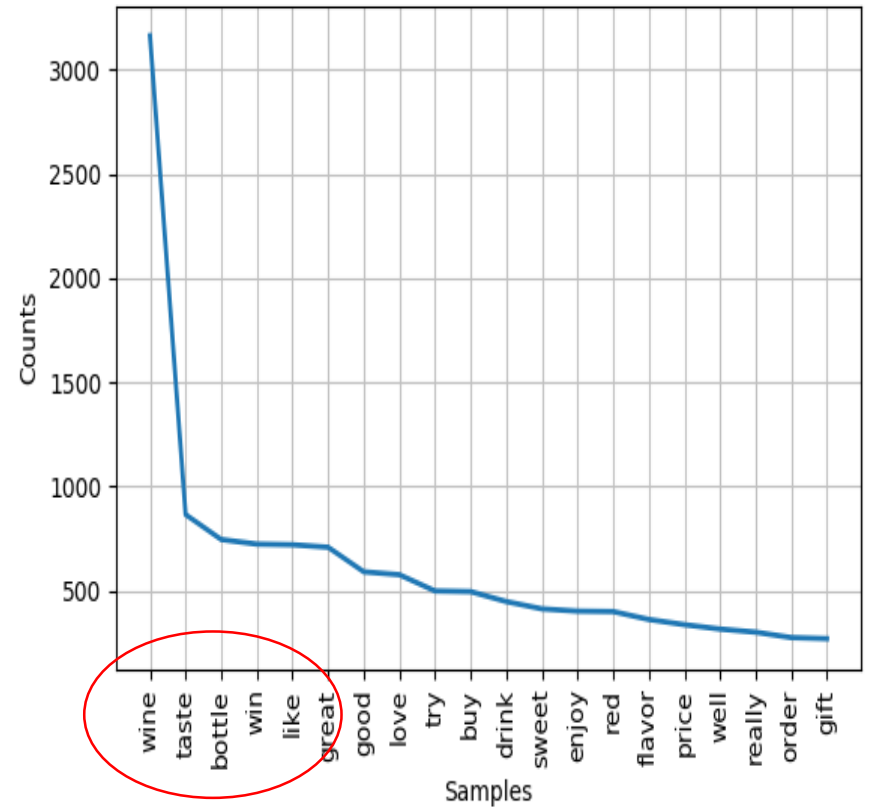


Figure 2 : Twenty most frequent words of the first fifteen experiments of wine reviews after preprocessing.

## 5.2 Results of aspects' extraction and expansion of them on thesauri.

Experiment	Reviews	Top-aspects (TOP_NN_VB_JJ)	Thesauri of top aspects
$A_1 - A_{15}$	total_A	<div> 'wine', 'great',  'good', 'bottle', 'taste',  'sweet', 'red', 'price',  'nice', 'pinot', 'fa-  vorite', 'flavor', 'gift',  'fruit', 'dinner', 'deli-  cious', 'perfect', 'try',  'love', 'drink', 'glass',  'cabernet', 'order',  'enjoy', 'food', 'white',  'dry', 'smooth', 'lit-  tle', ... </div>	<p>Example of aspect : wine</p> <p><b>synonyms_of_wine</b>=[ 'wine',  'vino', 'wine-colored', 'wine-  coloured']</p> <p><b>hyper-  nyms_of_wine</b>=[ 'alcohol',  'dark_red', 'drink', 'regale', ...]</p> <p><b>hyponyms_of_wine</b>=[ 'bor-  deaux', 'burgundy', 'tokay',  'varietal', 'vermouth', 'vin-  tage', ...]</p>
$A_{16}, A_{22}, A_{24}$	part_A_1	<div> 'wine', 'great', 'good',  'bottle', 'taste',  'sweet', 'red', 'price',  'flavor', 'nice', 'fa-  vorite', 'smooth', 'din-  ner', 'white', 'fruit',  'delicious', 'love',  'glass', 'cabernet',  'try', 'drink', 'fruity',  'merlot', 'pinot', 'gift',  'food', 'little', 'perfect',  'dry', ... </div>	<p>Example of aspect : fruit</p> <p><b>synonyms_of_fruit</b>=[ 'fruit',  'yield']</p> <p><b>hypernyms_of_fruit</b>=[  'product', 'consequence',  'bear']</p> <p><b>hyponyms_of_fruit</b>= [ 'ach-  ene', 'acorn', 'berry', 'buck-  thorn_berry', 'chokecherry',  'cubeb', 'drupe', ...]</p>
$A_{17}, A_{23}, A_{25}$	part_A_2	<div> 'wine', 'great', 'good',  'bottle', 'red', 'pinot',  'taste', 'sweet', 'gift',  'nice', 'price', 'fa-  vorite', 'winery',  'fruit', 'flavor', 'dry',  'delicious', 'order',  'dinner', 'love', 'try',  'buy', 'drink', 'year',  'family', 'enjoy',  'white', 'perfect',  'excellent', 'new', ... </div>	<p>Example of aspect : delicious</p> <p><b>synonyms_of_delicious</b>=[  'delightful', 'yummy', 'de-  licious', 'delectable', 'lus-  cious', ...]</p> <p><b>hypernyms_of_delicious</b>=[  'eating_apple']</p> <p><b>hyponyms_of_delicious</b>=  ['golden_delicious',  'red_delicious']</p>
$A_{18}$	part_A_a	<div> 'wine', 'good', 'bottle',  'great', 'taste', 'sweet',  'red', 'price', 'flavor',  'white', 'smooth',  'glass', 'fruit', 'dry',  'cabernet', 'delicious',  'dinner', 'drink', 'try',  'buy', 'love', 'food',  'merlot', 'fruity',  'pinot', 'gift', 'perfect',  'local', ... </div>	<p>Example of aspect : red</p> <p><b>synonyms_of_red</b>=[ 'red',  'redness', 'reddish', 'ruddy',  'cerise', 'cherry', 'crimson',  'ruby', ...]</p> <p><b>hypernyms_of_red</b>=[ 'sum',  'radical', 'chromatic_color']</p> <p><b>hyponyms_of_red</b>= [ 'cerise',  'chrome_red', 'crimson',  'dark_red', 'purplish_red',  'sanguine']</p>

A <sub>19</sub>	part_A_b	'wine', 'great', 'bot- tle', 'good', 'taste', 'sweet', 'finish', 'red', 'price', 'winery', 'fla- vor', 'love', 'nice', 'dinner', 'pinot', 'deli- cious', 'smooth', 'fruit', 'try', 'drink', 'cabernet', 'gift', 'glass', 'chocolate', 'fruity', 'enjoy', 'perfect', 'white', 'rich', 'big', ...]	Example of aspect : taste <b>synonyms_of_taste</b> =['taste', 'try', 'preference', 'penchant', 'savor'] <b>hypernyms_of_taste</b> =[ 'sensation', 'experience', 'exteroception', 'modality', 'sensing', ...] <b>hyponyms_of_taste</b> =[ 'bit- ter', 'finish', 'mellowness', 'relish', 'salt', 'sour', 'sweet']
A <sub>20</sub>	part_A_c	'wine', 'great', 'good', 'pinot', 'taste', 'nice', 'sweet', 'favorite', 'gift', 'flavor', 'fruit', 'price', 'winery', 'dinner', 'love', 'drink', 'family', 'buy', 'glass', 'order', 'perfect', 'white', 'dif- ferent', 'recommend', 'finish', 'dry', ...]	Example of aspect : recom- mend <b>synonyms_of_recommend</b> =[ 'urge', 'advocate', 'com- mend', 'recommend'] <b>hypernyms_of_recommend</b> =[ 'praise', 'propose', 'change'] <b>hyponyms_of_recommend</b> = [
A <sub>21</sub>	part_A_d	'wine', 'great', 'good', 'bottle', 'sweet', 'foxen', 'red', 'taste', 'gift', 'price', 'nice', 'favorite', 'winery', 'order', 'perfect', 'dry', 'love', 'try', 'buy', 'drink', 'en- joy', 'dinner', 'year', 'fruit', 'flavor', 'club', 'white', 'new', 'little', 'wonderful', ...]	Example of aspect : drink <b>synonyms_of_drink</b> =[ 'booz- ing', 'beverage', 'potable', 'drink', 'swallow', 'toast', 'pledge', 'salute'] <b>hypernyms_of_drink</b> =['food', 'liquid'] <b>hyponyms_of_drink</b> =[ 'draft', 'nightcap', 'sanga- ree', 'alcohol', 'cider', 'cocoa', 'coffee', 'gulp', 'oenomet', 'wine', ...]

Table 3 : Results of the aspects' extraction and expansion of them on thesauri of the wine reviews.

## 5.3 Results of the query system for the most relevant reviews.

Exp.	Preprocessed Query	Expansion of Query	Score_tfidf and 5 most Relevant Reviews (R)	Score and 5 most Rel. Rev. (R) without expansion
A <sub>1</sub>	[ 'bottle', 'good', 'wine' ]	YES	(0.45931, R:72) (0.45951, R:1009) (0.30111, R:263) (0.30111, R:274) (0.30111, R:364)	(0.01687, R:5) (0.01687, R:17) (0.01687, R:18) (0.01687, R:24) (0.01687, R:34)
A <sub>2</sub>	[ 'bottle', 'good', 'red', 'wine' ]	YES	(0.49126, R:72) (0.47603, R:1009) (0.27338, R:263) (0.27338, R:364) (0.27338, R:841)	(0.05856, R:100) (0.05856, R:152) (0.05856, R:263) (0.05856, R:265) (0.05856, R:273)
A <sub>3</sub>	[ 'bottle', 'good', 'sweet', 'wine' ]	YES	(0.72140, R:81) (0.66291, R:1058) (0.57089, R:72) (0.57089, R:1057) (0.57089, R:1102)	(0.06573, R:34) (0.06573, R:65) (0.06573, R:135) (0.06573, R:210) (0.06573, R:233)
A <sub>4</sub>	[ 'bottle', 'good', 'red', 'sweet', 'wine' ]	YES	(0.67943, R:72) (0.67943, R:81) (0.58742, R:1058) (0.56146, R:1057) (0.56146, R:1102)	(0.08226, R:310) (0.06552, R:9) (0.06552, R:34) (0.06552, R:64) (0.06552, R:65)
A <sub>5</sub>	[ 'bot- tle', 'cheap', 'red', 'sweet', 'wine' ]	YES	(0.56971, R:81) (0.51122, R:188) (0.41921, R:72) (0.41921, R:274) (0.41921, R:1057)	(0.08226, R:492) (0.06552, R:9) (0.06552, R:180) (0.06552, R:200) (0.06552, R:225)
A <sub>8</sub>	[ 'bottle', 'good', 'cheap', 'red', 'sweet', 'wine' ]	YES	(0.67943, R:72) (0.67943, R:81) (0.58742, R:1058) (0.56146, R:180) (0.56146, R:274)	(0.082226, R:310) (0.082226, R:492) (0.08226, R:829) (0.08226, R:2190) (0.08226, R:9)
A <sub>7</sub>	[ 'bottle', 'good', 'cheap', 'white', 'dry', 'wine' ]	YES	(0.51807, R:72) (0.51807, R:1009) (0.35967, R:274) (0.31542, R:263) (0.31542, R:1057)	(0.10060, R:2190) (0.07544, R:17) (0.07544, R:72) (0.07544, R:79) (0.07544, R:135)

A <sub>8</sub>	[ 'choose', 'pasta', 'menu' ]	NO	(0.02582, R:1) (0.02582, R:40) (0.02582, R:72) (0.02582, R:86) (0.02582, R:117)
A <sub>9</sub>	[ 'choose', 'menu', 'many', 'different', 'choose' ]	NO	(0.05019, R:10) (0.05019, R:72) (0.05019, R:79) (0.05019, R:207) (0.05019, R:211)
A <sub>10</sub>	[ 'choose', 'sushi', 'menu' ]	NO	(0.07965, R:40) (0.04527, R:117) (0.04527, R:125) (0.04527, R:243) (0.04527, R:310)
A <sub>11</sub>	[ 'choose', 'menu', 'meat' ]	NO	(0.02484, R:1) (0.02484, R:40) (0.02484, R:80) (0.02484, R:117) (0.02484, R:125)
A <sub>12</sub>	[ 'choose', 'menu', 'fish' ]	NO	(0.02736, R:1) (0.02736, R:40) (0.02736, R:72) (0.02736, R:105) (0.02736, R:117)
A <sub>13</sub>	[ 'cham- pagne', 'celebration' ]	NO	(0.03772, R:23) (0.03772, R:58) (0.03772, R:70) (0.03772, R:92) (0.03772, R:139)
A <sub>14</sub>	[ 'bottle', 'cabernet' ]	YES	(0.04699, R:361) (0.04044, R:65) (0.04044, R:66) (0.04044, R:73) (0.04044, R:79)
A <sub>15</sub>	[ 'sauvi- gnon', 'blanc' ]	NO	(0.16332, R:25) (0.16332, R:58) (0.16332, R:75) (0.16332, R:139) (0.16332, R:221)
A <sub>16</sub>	[ 'bottle', 'good', 'wine' ]	YES	(0.42717, R:72) (0.42717, R:1009) (0.28758, R:263) (0.28758, R:274) (0.28758, R:364)
A <sub>17</sub>	[ 'bottle', 'good', 'wine' ]	YES	(0.20844, R:2190) (0.20154, R:2045) (0.18179, R:2169) (0.18179, R:2175) (0.17778, R:1206)

$A_{18}$	[ 'bottle', 'good', 'wine' ]	YES	(0.39454, R:72) (0.39454, R:364) (0.27377, R:81) (0.27377, R:93) (0.27377, R:263)
$A_{19}$	[ 'bottle', 'good', 'wine' ]	YES	(0.46577, R:1009) (0.43194, R:1102) (0.42535, R:1058) (0.42535, R:1065) (0.40235, R:753)
$A_{20}$	[ 'bottle', 'good', 'wine' ]	YES	(0.17363, R:1206) (0.17363, R:1228) (0.17363, R:1271) (0.17363, R:1280) (0.17363, R:1465)
$A_{21}$	[ 'bottle', 'good', 'wine' ]	YES	(0.31464, R:2190) (0.28843, R:2045) (0.23704, R:2169) (0.23704, R:2175) (0.22165, R:2376)
$A_{22}$	[ 'bottle', 'good', 'cheap', 'red', 'sweet', 'wine' ]	YES	(0.63379, R:72) (0.63379, R:81) (0.54678, R:1058) (0.52069, R:180) (0.52069, R:274)
$A_{23}$	[ 'bottle', 'good', 'cheap', 'red', 'sweet', 'wine' ]	YES	(0.48505, R:2190) (0.30347, R:1396) (0.30347, R:1541) (0.26938, R:1206) (0.26938, R:1520)
$A_{24}$	[ 'bottle', 'good', 'cheap', 'white', 'dry', 'wine' ]	YES	(0.48505, R:72) (0.34546, R:1009) (0.34546, R:274) (0.30454, R:263) (0.30454, R:1057)
$A_{25}$	[ 'bottle', 'good', 'cheap', 'white', 'dry', 'wine' ]	YES	(0.28225, R:2190) (0.20844, R:1280) (0.20844, R:2045) (0.20154, R:1575) (0.20154, R:2175)

Table 4: Query system and the five most relevant reviews to user's query of the experiments of wine reviews.



# **6.**

## **Conclusion**



## Conclusion-Future work

---

- ❖ Pre-processing of data and user's query contributed to the reduction of the volume of the data and to the transformation of questions in the latter of keywords.
- ❖ The extraction of aspect words was an essential procedure for the increase of the accuracy of our system, as most information and opinions are gathered on these words.
- ❖ The expansion of the queries to synonyms, hypernyms, or hyponyms of the aspect words turned out necessary, as many times an individual is searching for a product or an idea with specific aspects and expresses it on an equivalent way. Also in this way we can obtain more accurate results.

**Future work :** A good thought would be to take advantage of further elements of the reviews (e.g. “helpful” or “reviewTime”) in order to enhance our system with a method that will also generate results ranked by other criteria (e.g. reliability or date).



---

Σας ευχαριστώ πολύ για την προσοχή σας!