



ENHANCING E-COMMERCE:
“MULTIMODAL PRODUCT DATA CLASSIFICATION”



DataScientest.com
jun23_bootcamp_ds

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12/09/2023



PROJECT
DESCRIPTION

THE REALM OF E-COMMERCE





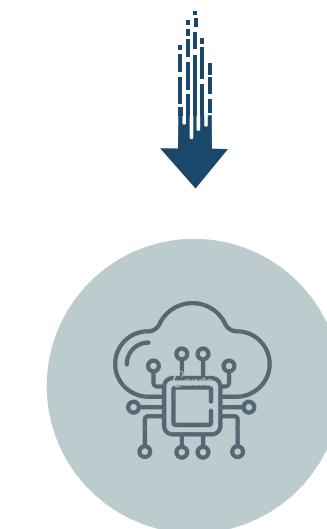
PROJECT
DESCRIPTION

THE REALM OF E-COMMERCE



Understand the buyers wants.

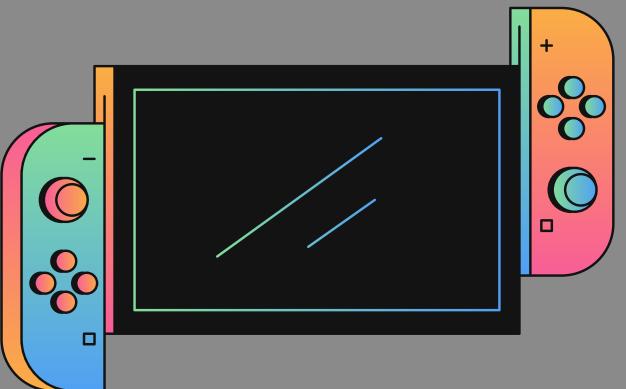
Understand the sellers products.



- Process text information
- Process image information
- Classify products

DATASETS

Product Title



Product Description

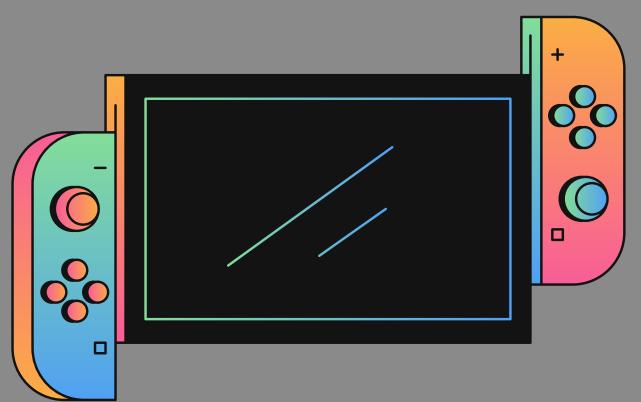
specifications
brand, details,
color & size

DATASETS

Text Data

		Title	description	productid	imageid
76291	Fullmetal Alchemist Figurine Riza Hawkeye 10 Cm	Trading figurine d'une taille de 10 cm environ...		304773553	996061500
35651	Mebby Biberon Vetro 270ml Lattice Blu		* NaN	1233521151	1233288653
23689	Chaise De Plage Hwc-A11 Mer Du Nord Bâche Incl...	Chaise de plage HWC-A11 mer du Nord bâche incl...		3738732335	1239669685
27954	Mini Fc 129 Console De Jeu Vidéo Rétro Jeu Min...	Numéro du modèle:Handheld retro Players A...		4200877059	1316192545
53964	Brosses à lamelles R9022 Zodiac Vortex 4 - La ...	Utilisation des brosses à lamelles R9022 Zodia...		207257892	941677156

Product Title



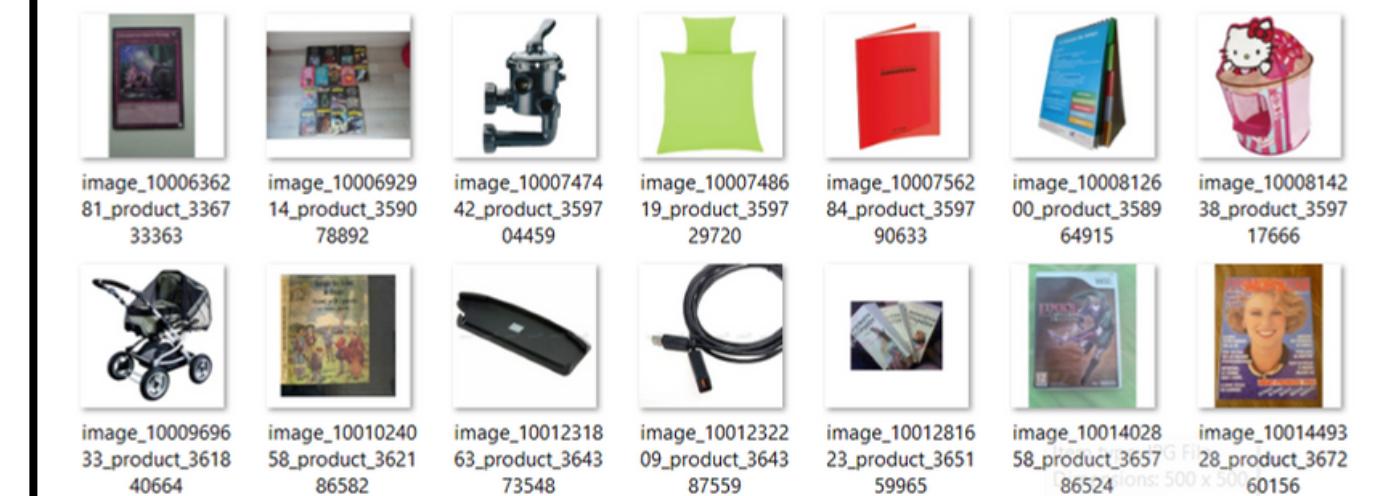
Product Description

specifications
brand, details,
color & size

Target

	prdtypecode	protype
76291	1140	goodies_geek
35651	1320	petite_enfance
23689	2582	mobilier_jardin_cuisine
27954	60	jeux_et_consoles_retro
53964	2583	piscine_spa

Image Data

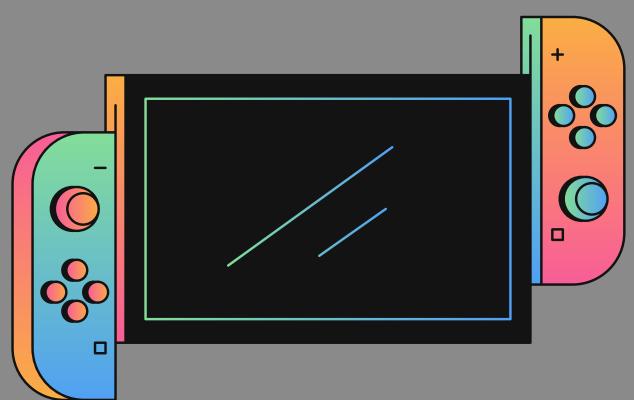


DATASETS

Text Data

		Title	description	productid	imageid
76291	Fullmetal Alchemist Figurine Riza Hawkeye 10 Cm	Trading figurine d'une taille de 10 cm environ...	304773553	996061500	
35651	Mebby Biberon Vetro 270ml Lattice Blu		* NaN	1233521151	1233288653
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53964	Brosses à lamelles R9022 Zodiac Vortex 4 - La ...	Utilisation des brosses à lamelles R9022 Zodia...	207257892	941677156	

Product Title



Product Description

specifications
brand, details,
color & size

Target

prdtypecode	protype
76291	1140 goodies_geek
35651	1320 petite_enfance
23689	2582 mobilier_jardin_cuisine
27954	60 jeux_et_consoles_retro
53964	2583 piscine_spa

Image Data



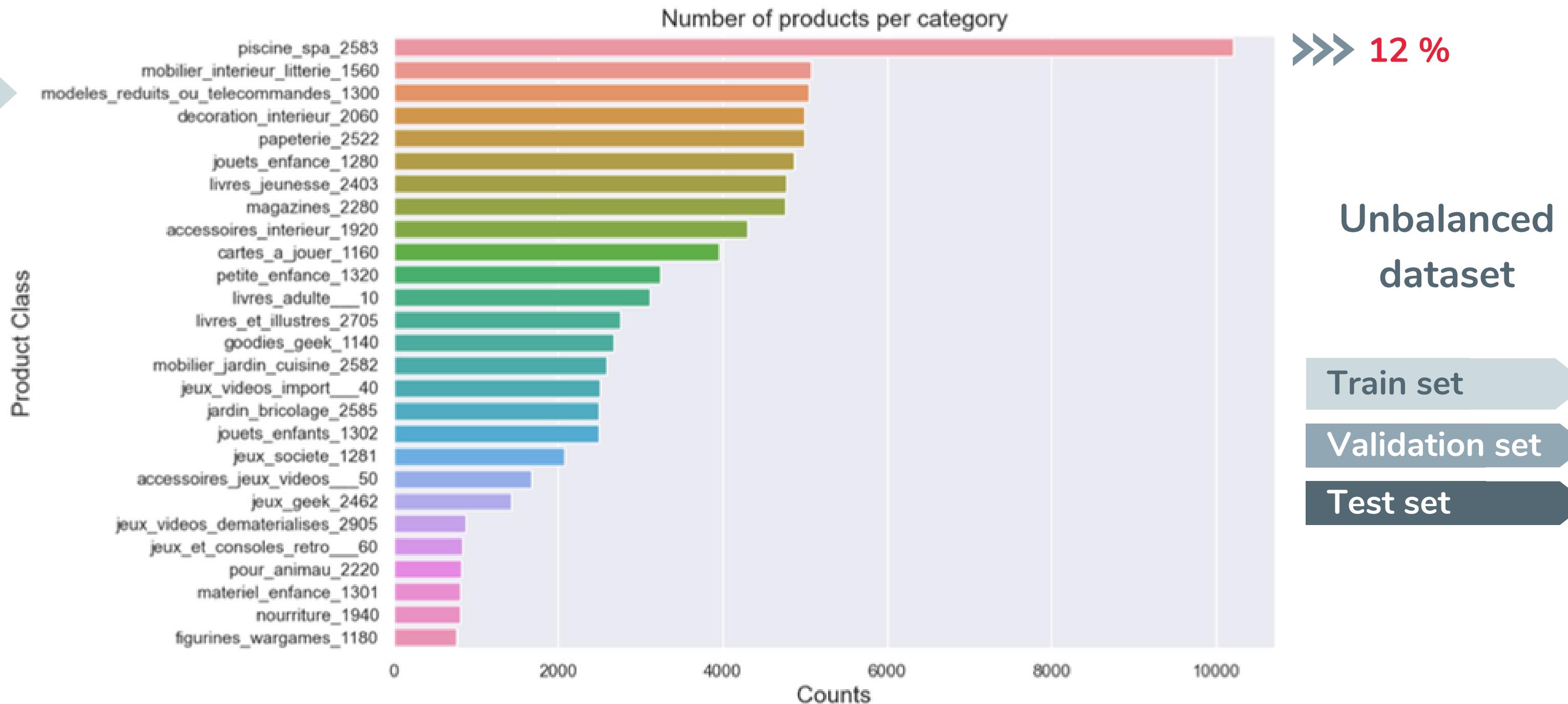
85 K
Products

27
Categories

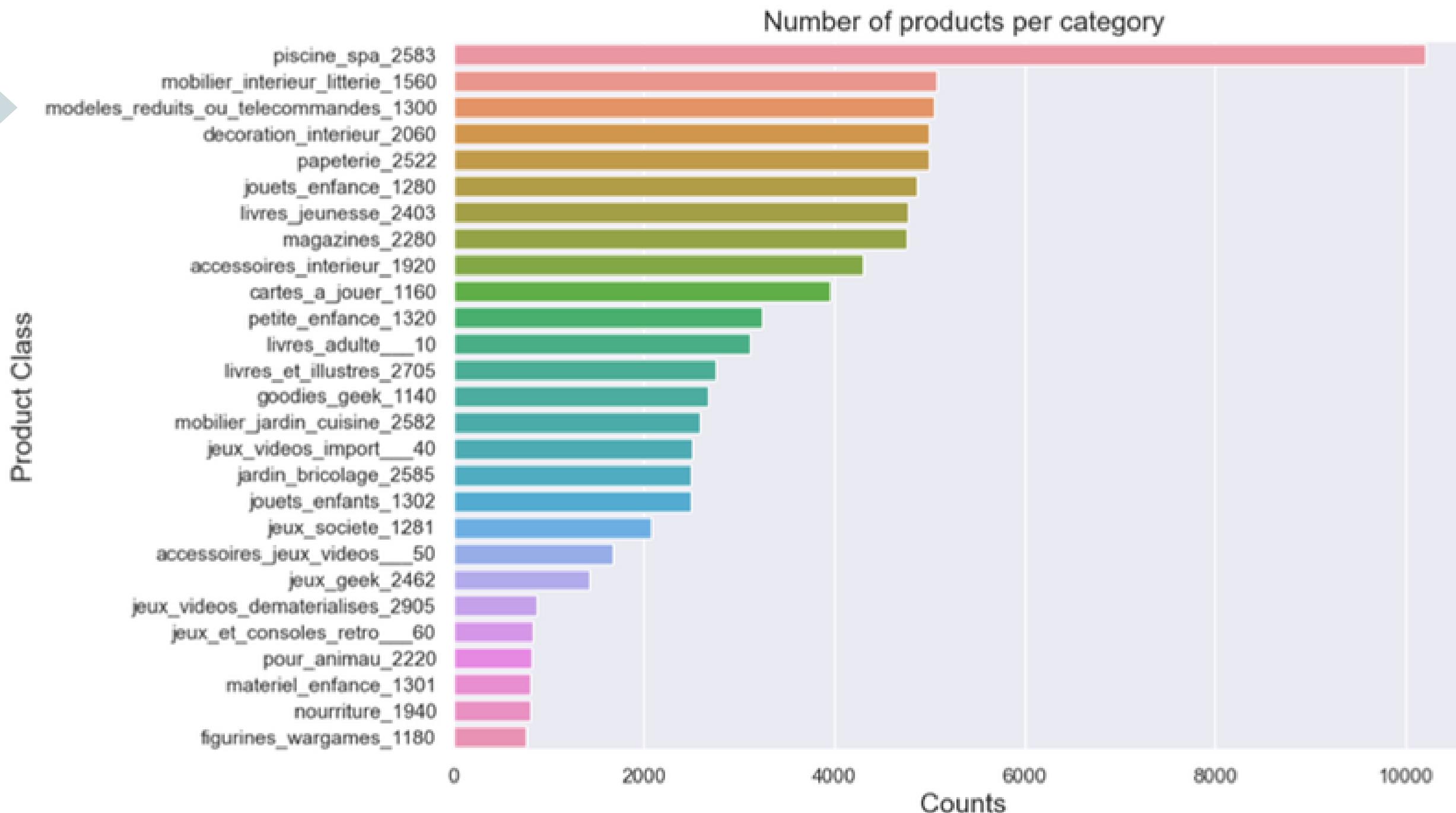
60 MB
Text Data

2.2 Gb
Image Data

TEXT DATA EXPLORATION



TEXT DATA EXPLORATION



>>> 12 %

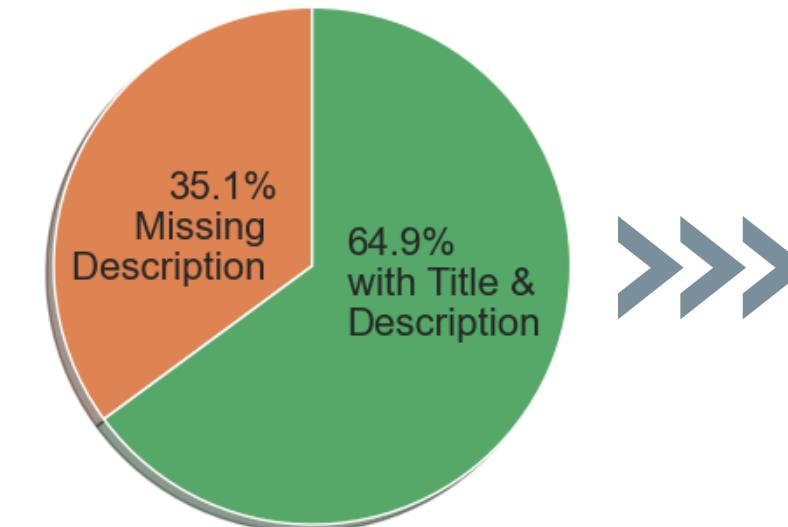
Unbalanced dataset

Train set

Validation set

Test set

Missing Values



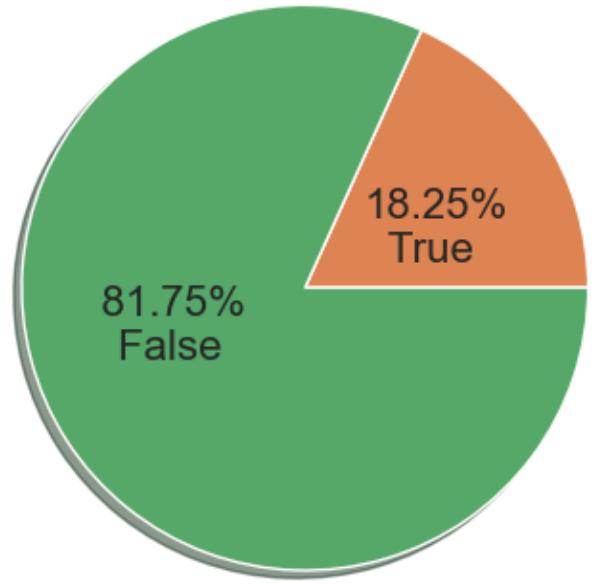
Feature Engineering

Title > Description

Text Data

TEXT DATA PREPROCESSING

Is text HTML encoded ?

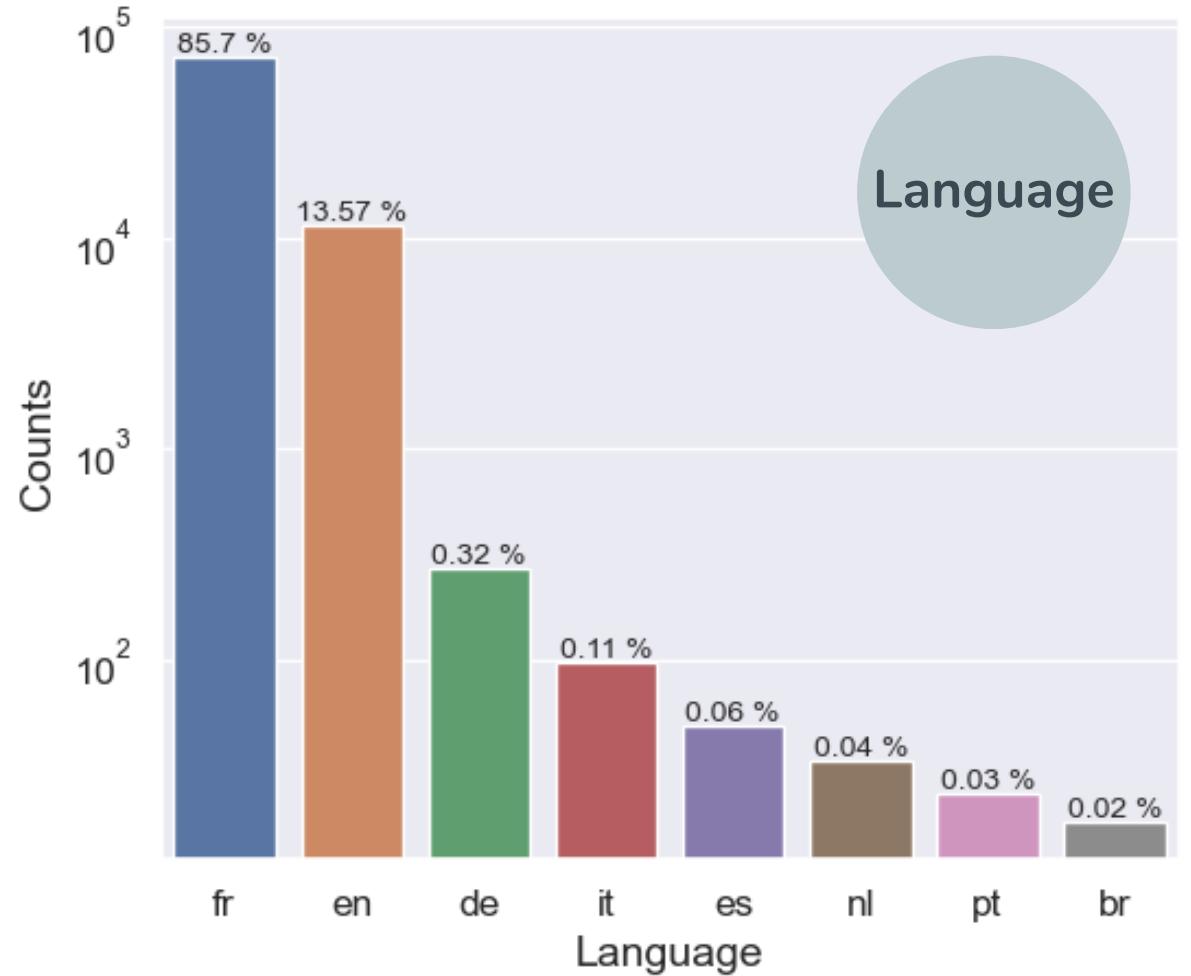
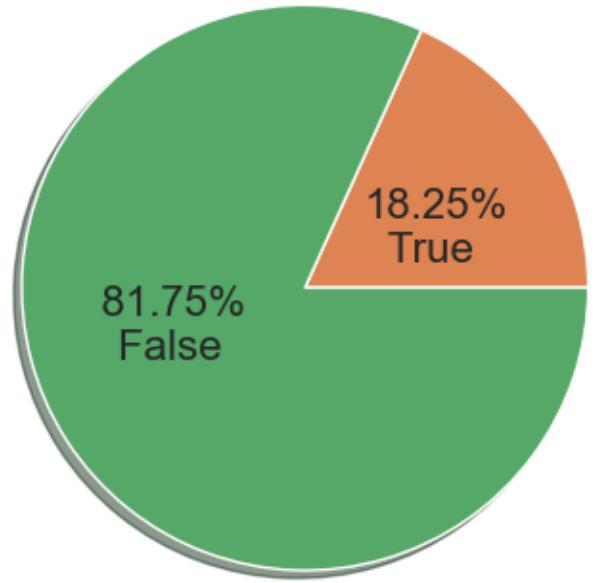


HTML
parsing

Beautiful Soup

TEXT DATA PREPROCESSING

Is text HTML encoded ?



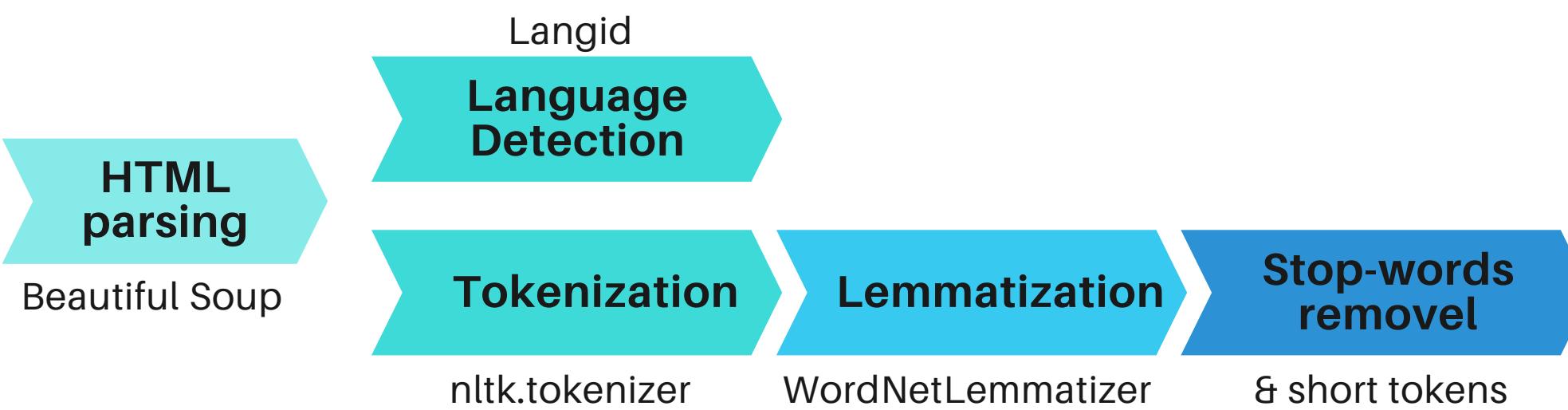
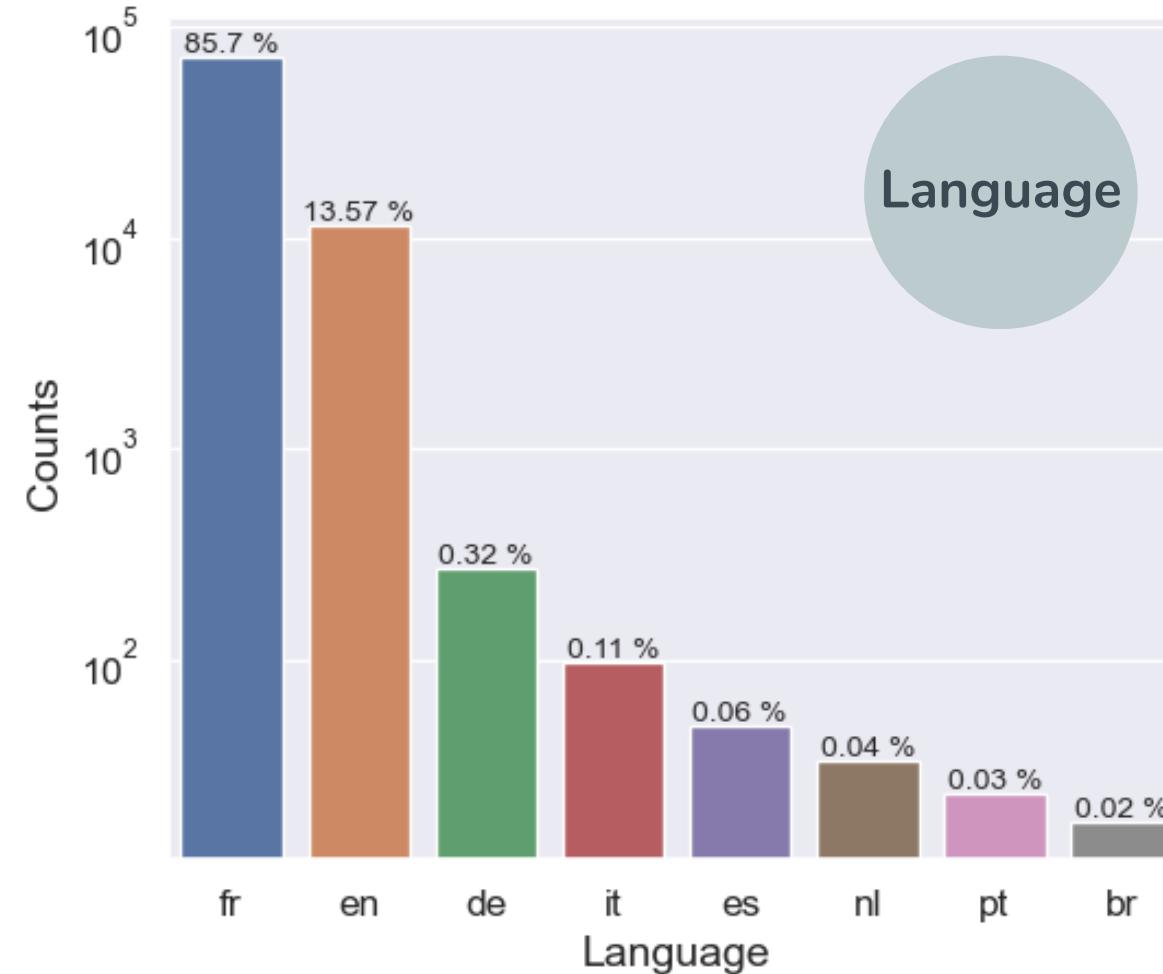
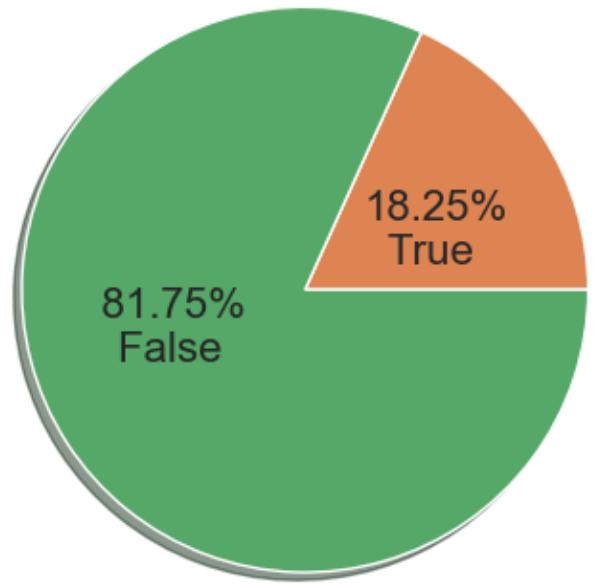
HTML
parsing

Beautiful Soup

Langid
**Language
Detection**

TEXT DATA PREPROCESSING

Is text HTML encoded ?



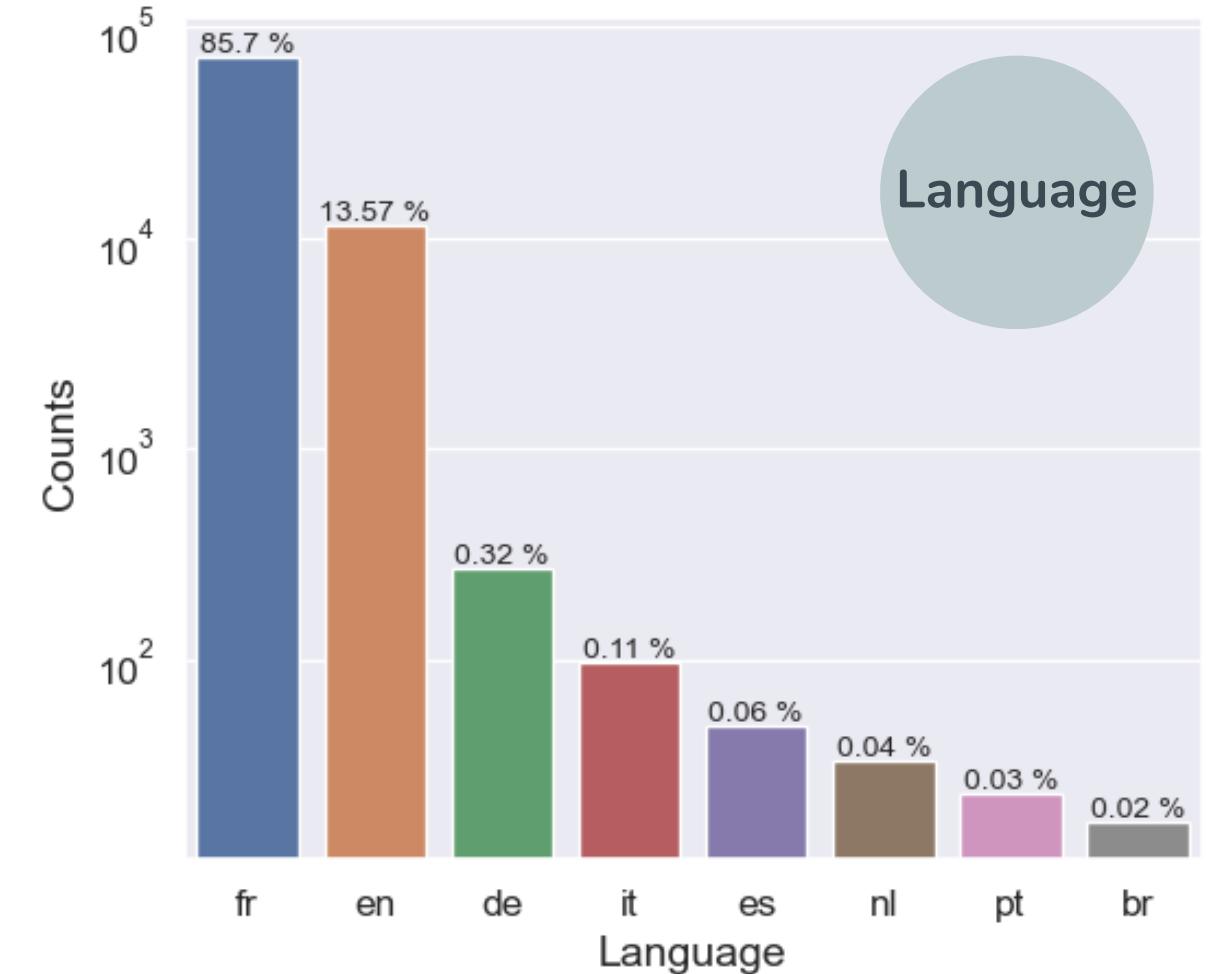
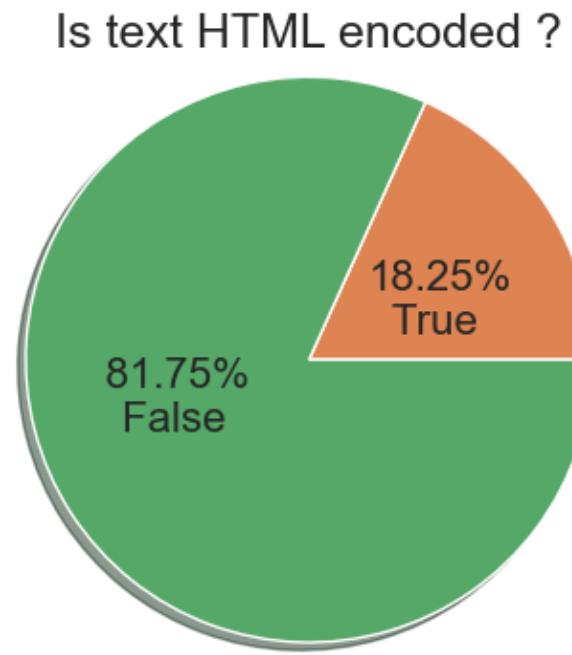
Text Features

Nb of Tokens

List of Tokens

>>> TF-IDF vectorized

TEXT DATA PREPROCESSING



**HTML
parsing**

Beautiful Soup

**Language
Detection**

Langid

**Language
Detection**

Tokenization

nltk.tokenizer

Lemmatization

WordNetLemmatizer

**Stop-words
removal**
& short tokens

Text Features

Nb of
Tokens

List of
Tokens

>>> TF-IDF vectorized

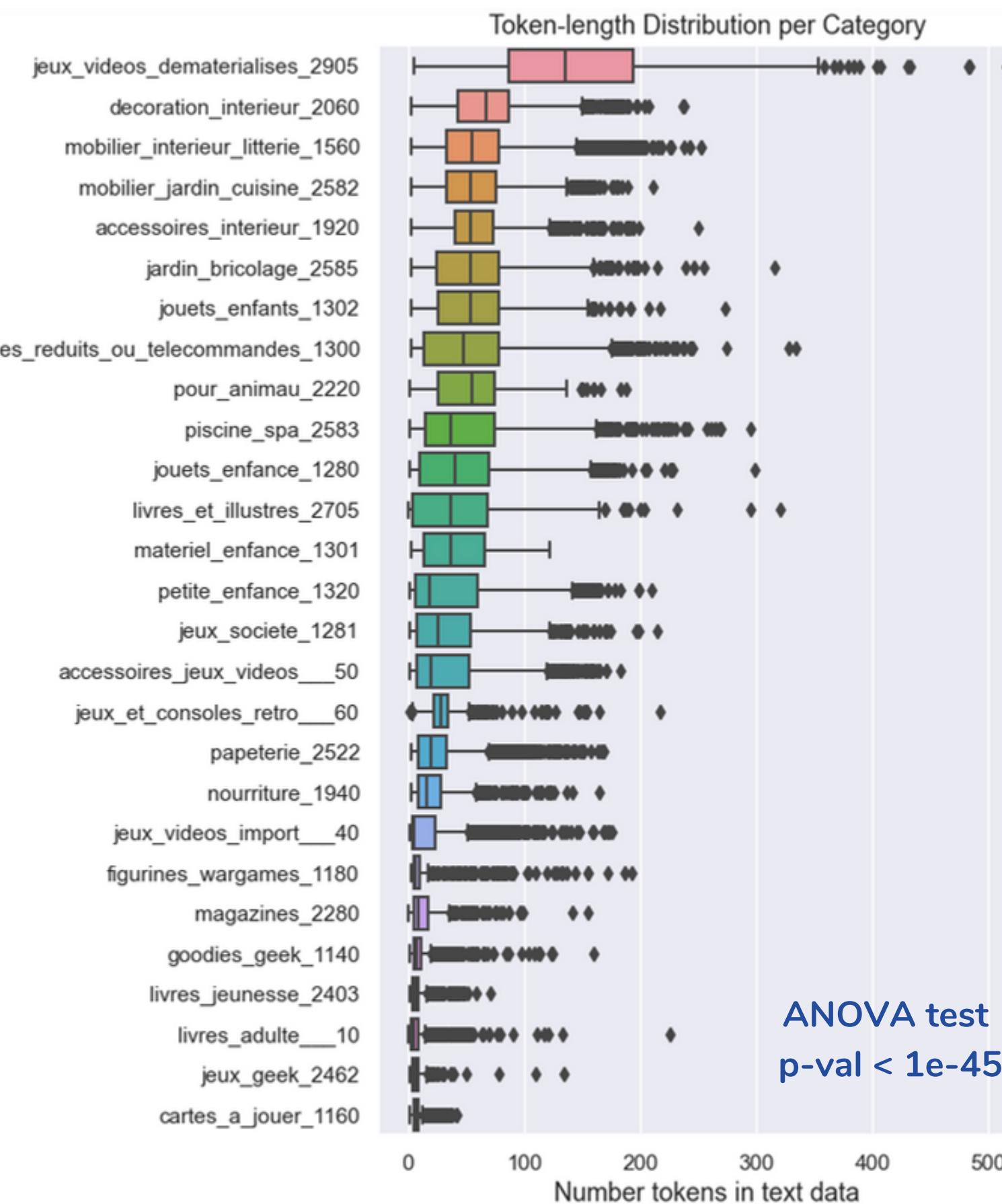


IMAGE DATA EXPLORATION

image shape = (500, 500, 3)



image shape = (356, 356, 3)



Mean RGB

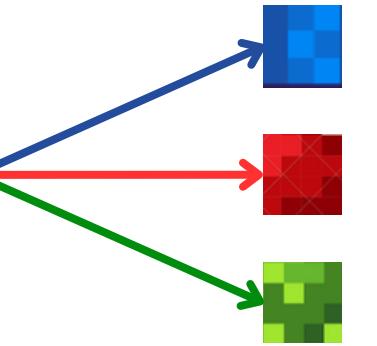
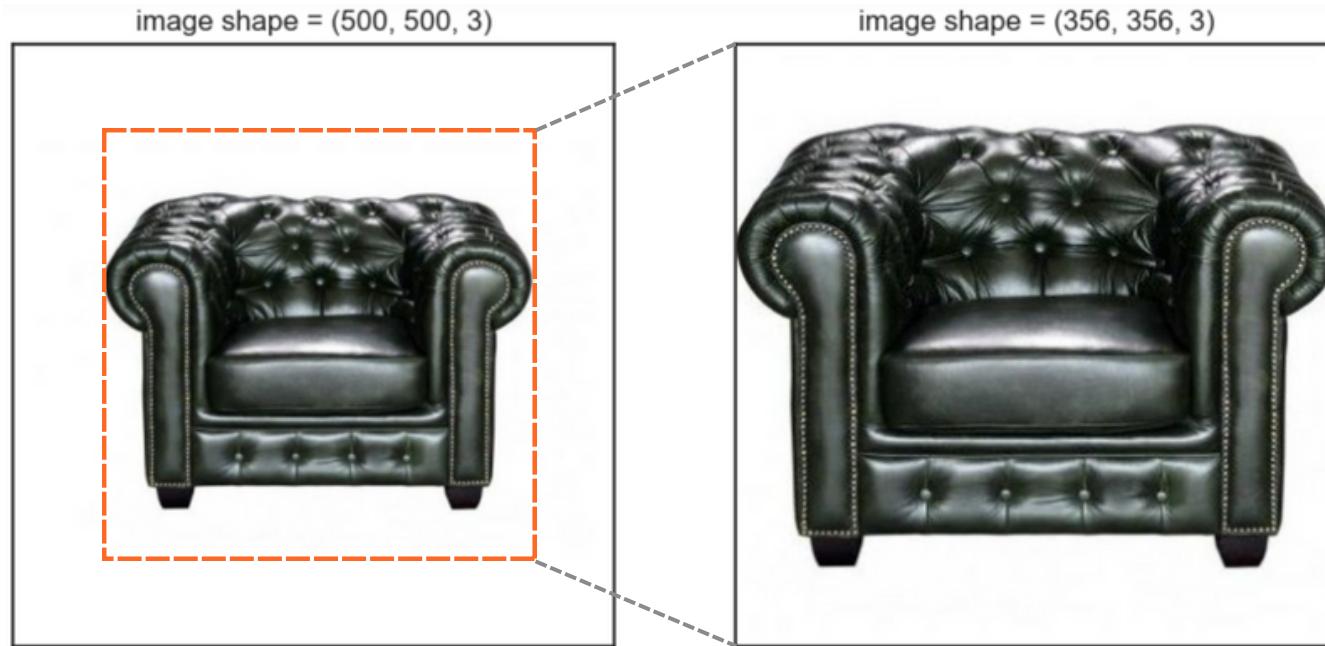
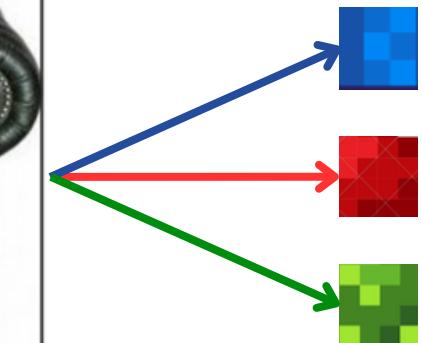


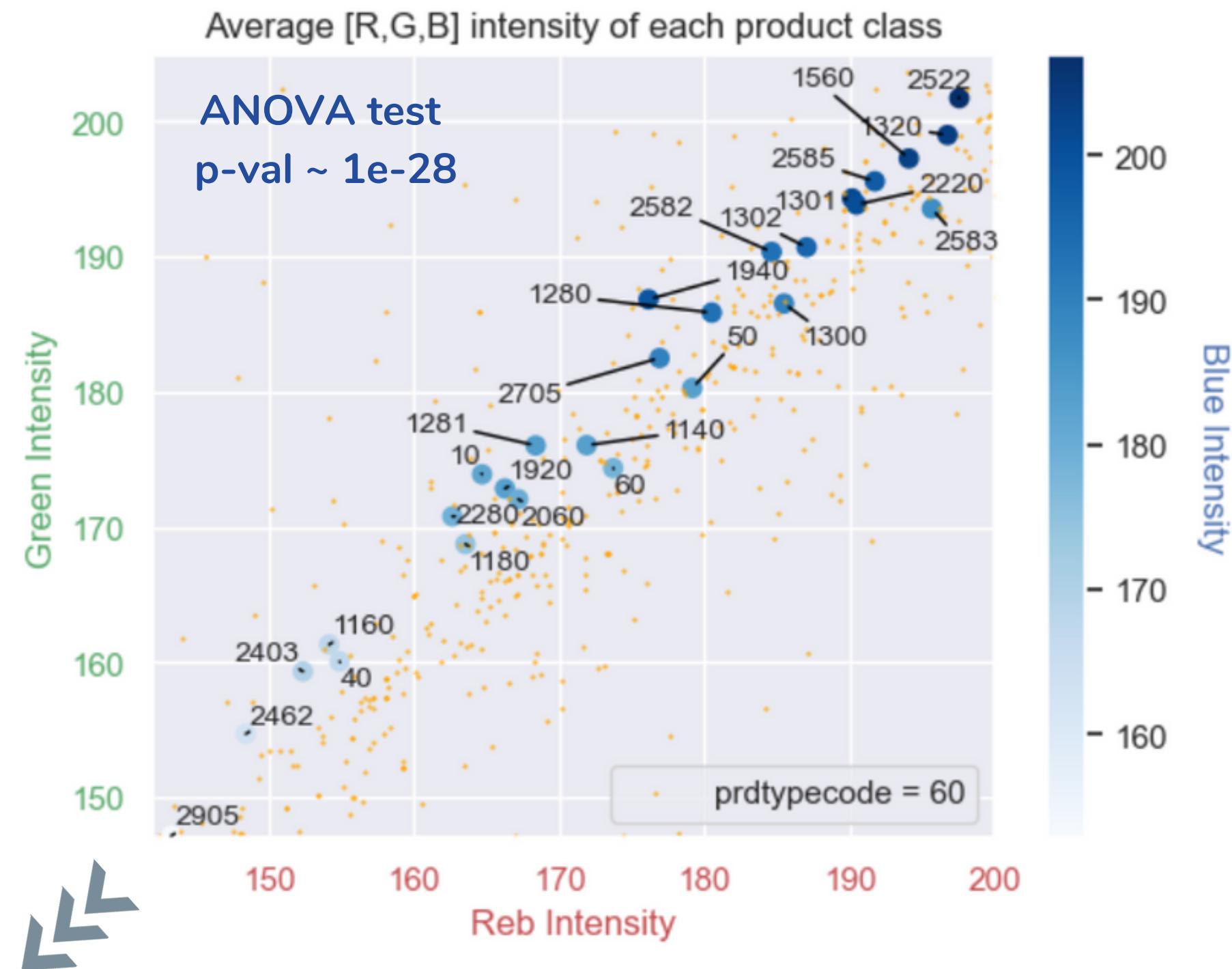
IMAGE DATA EXPLORATION



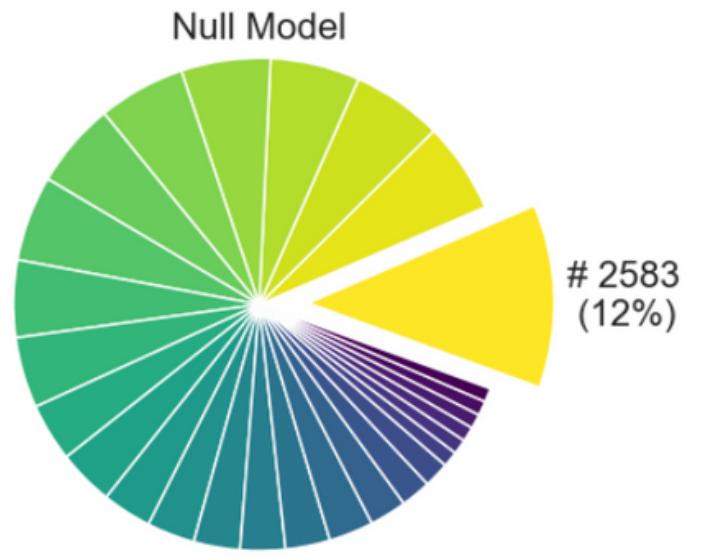
Mean RGB



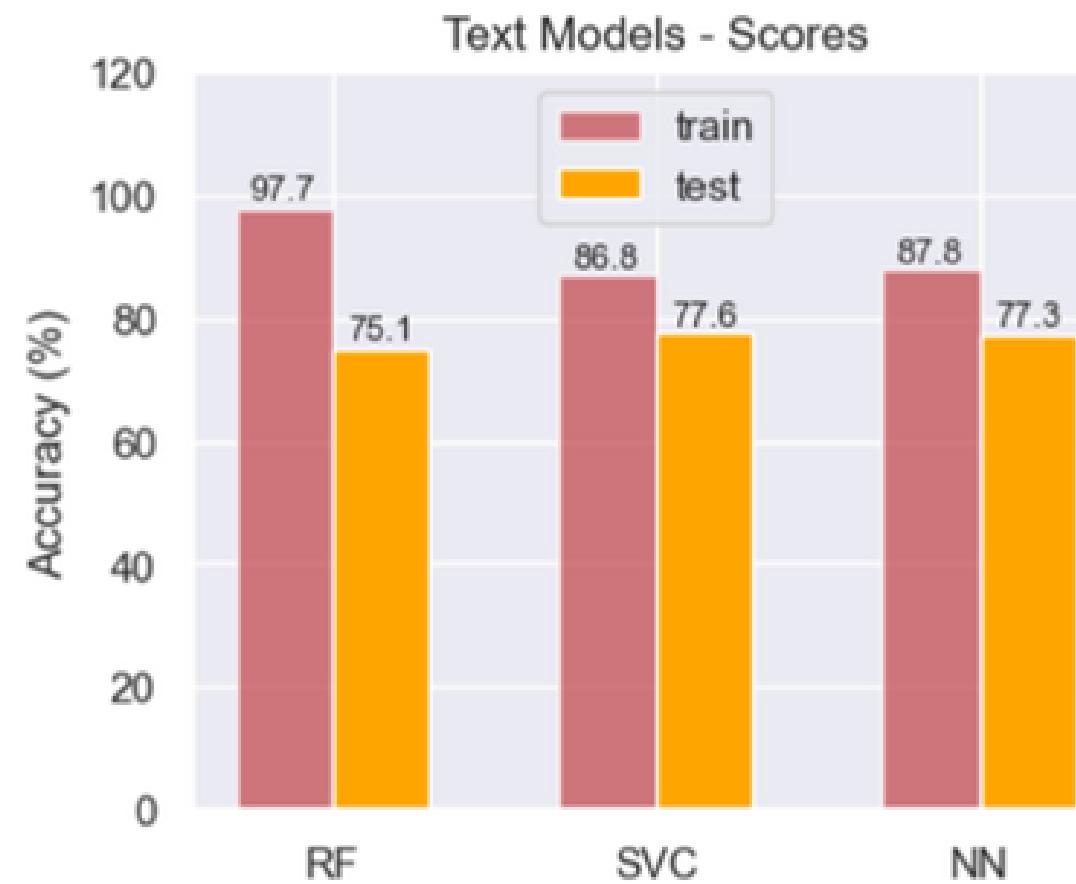
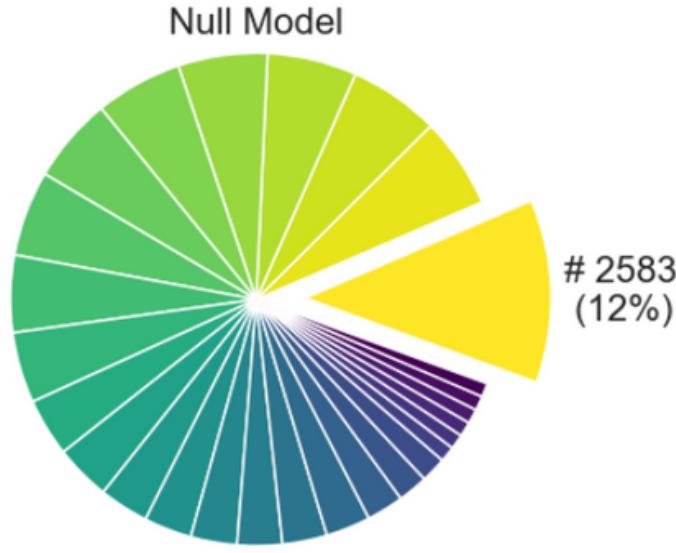
No clusters



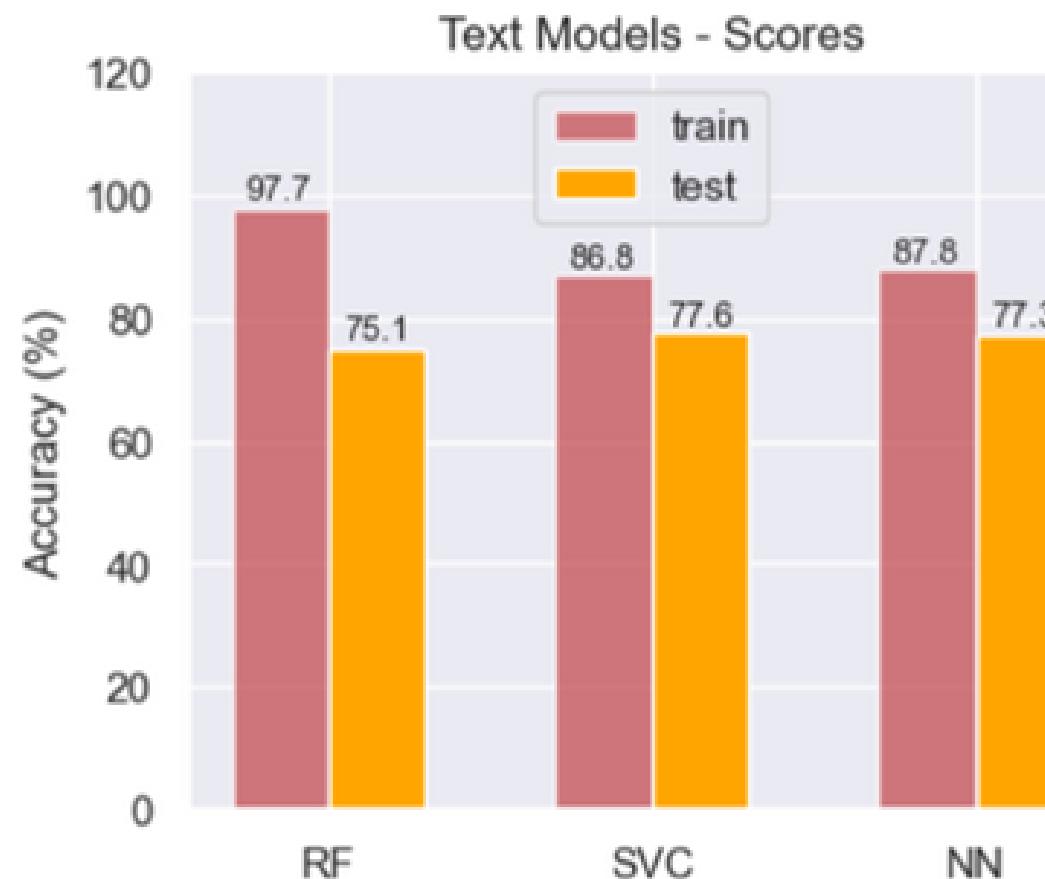
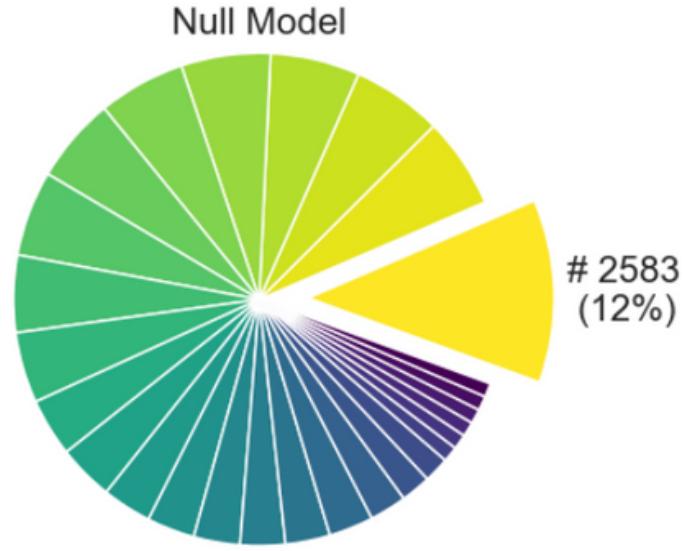
TEXT BASE MODELS



TEXT BASE MODELS



TEXT BASE MODELS



Dense Neural Network

Layer	Output shape	Param #	Activation size
Input(shape = Nb_features)	(5035)	0	5035
Dense(units = 256, activation = 'relu')	256	1.289.216	256
Dropout(rate = 0.7)	256	0	256
Output_layer = Dense(units = Nb_classes, activation = 'softmax')	27	6939	27

Total params: 1.296.155
Trainable params: 1.296.155
Non-trainable params: 0

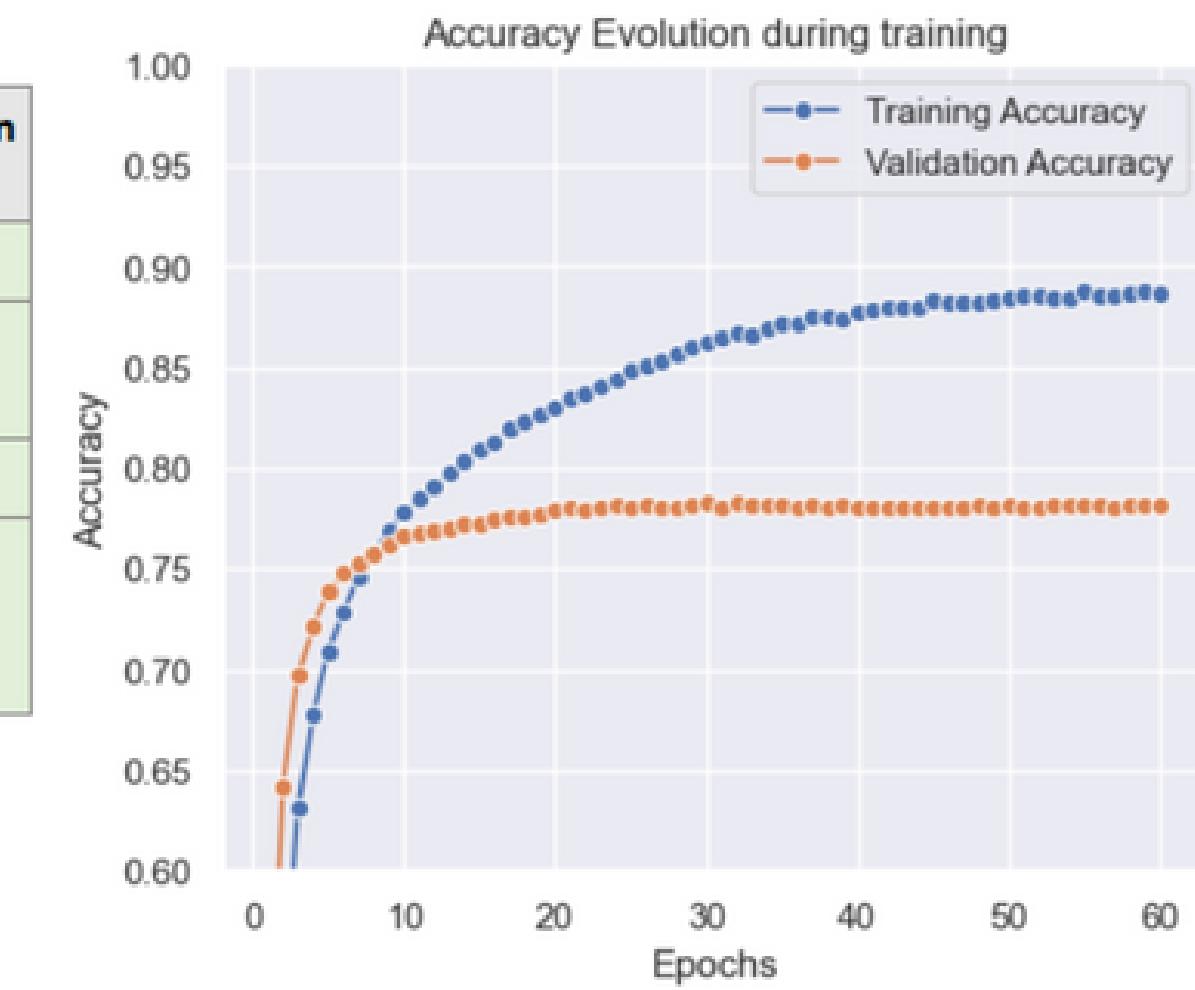


IMAGE BASE MODELS

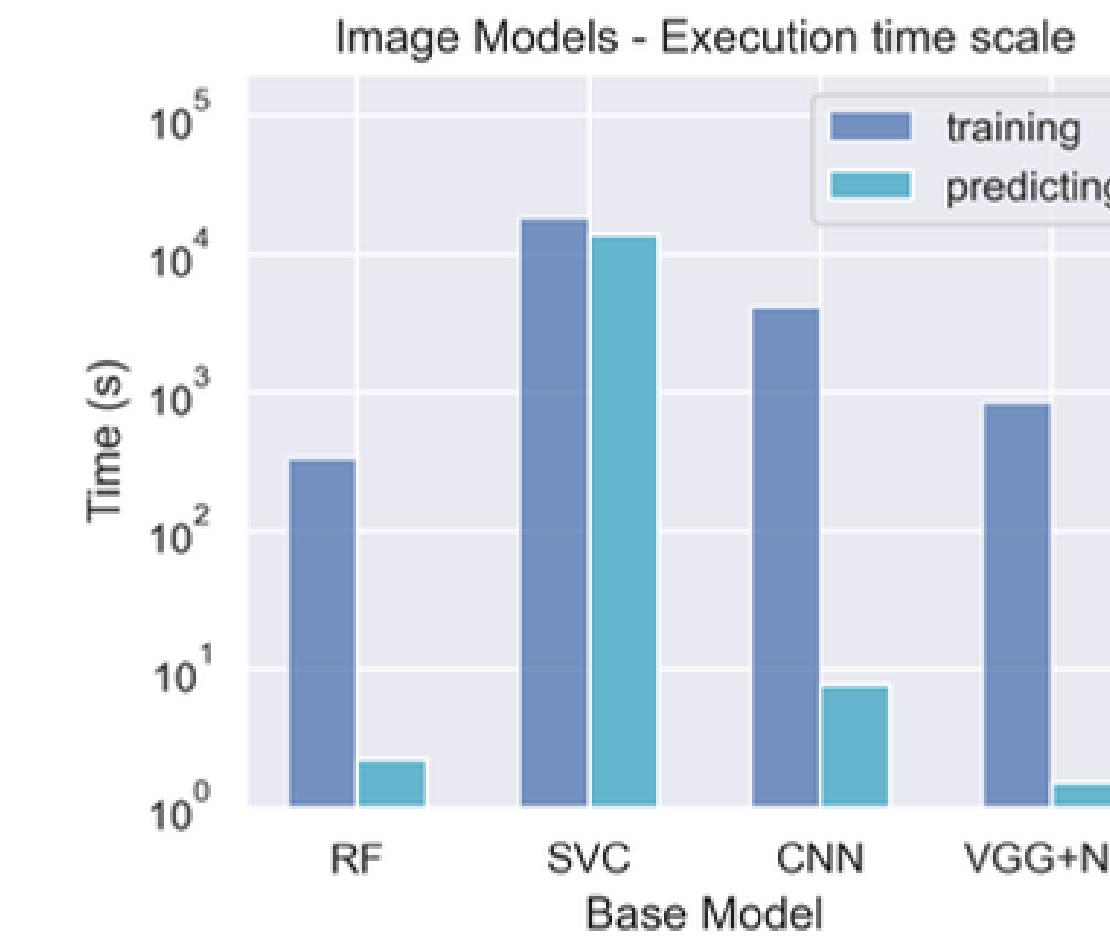
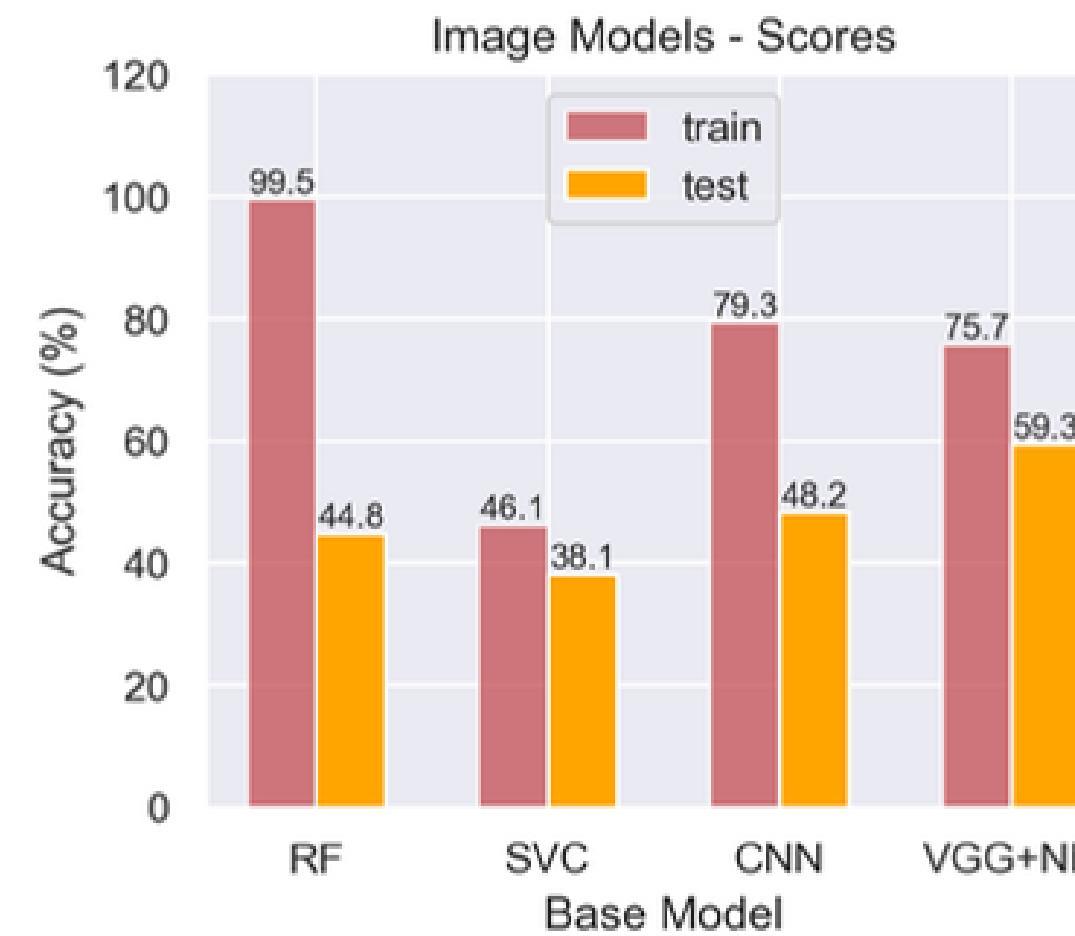


IMAGE BASE MODELS

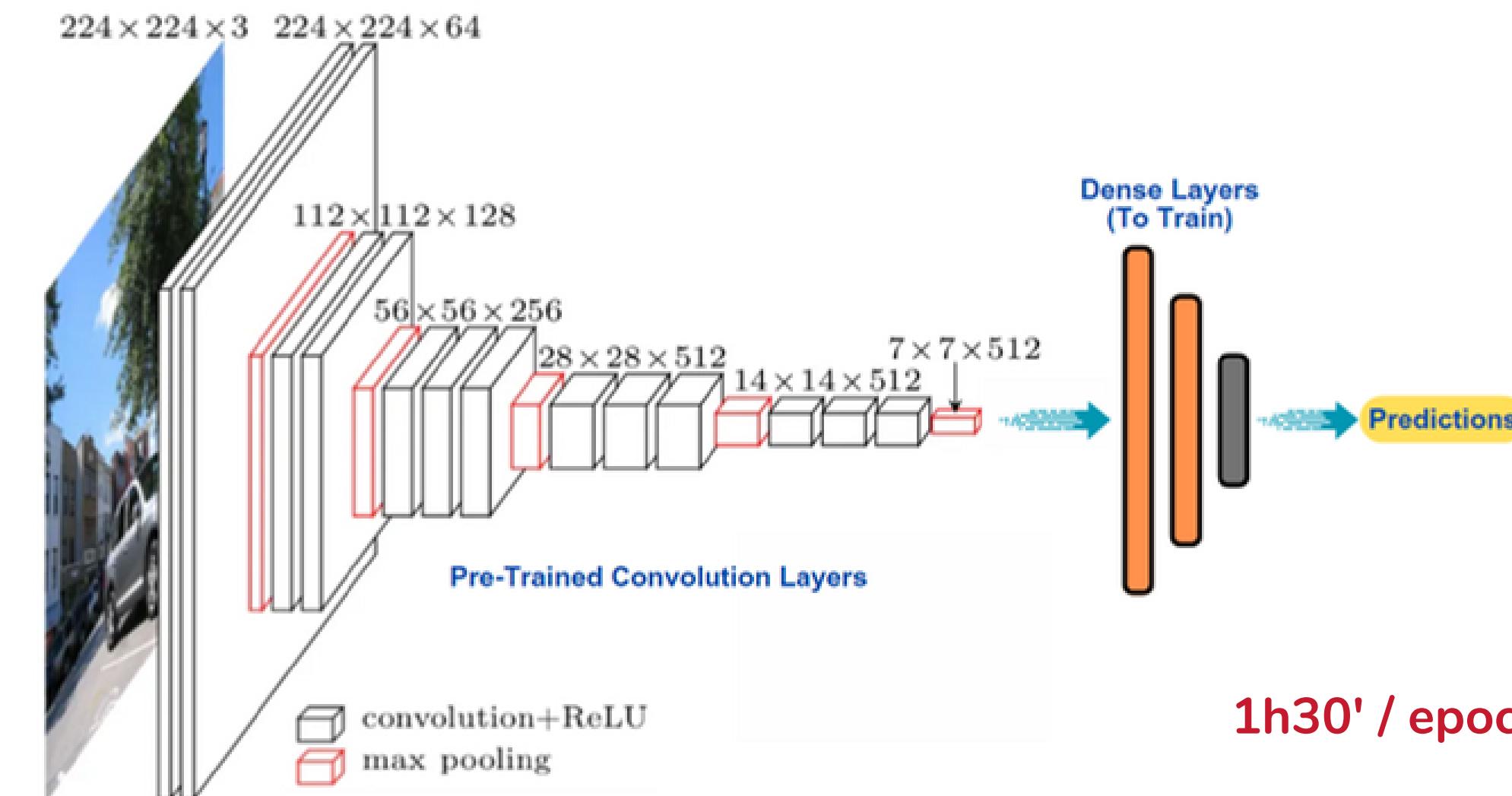


Vgg16 +
Neural Net.



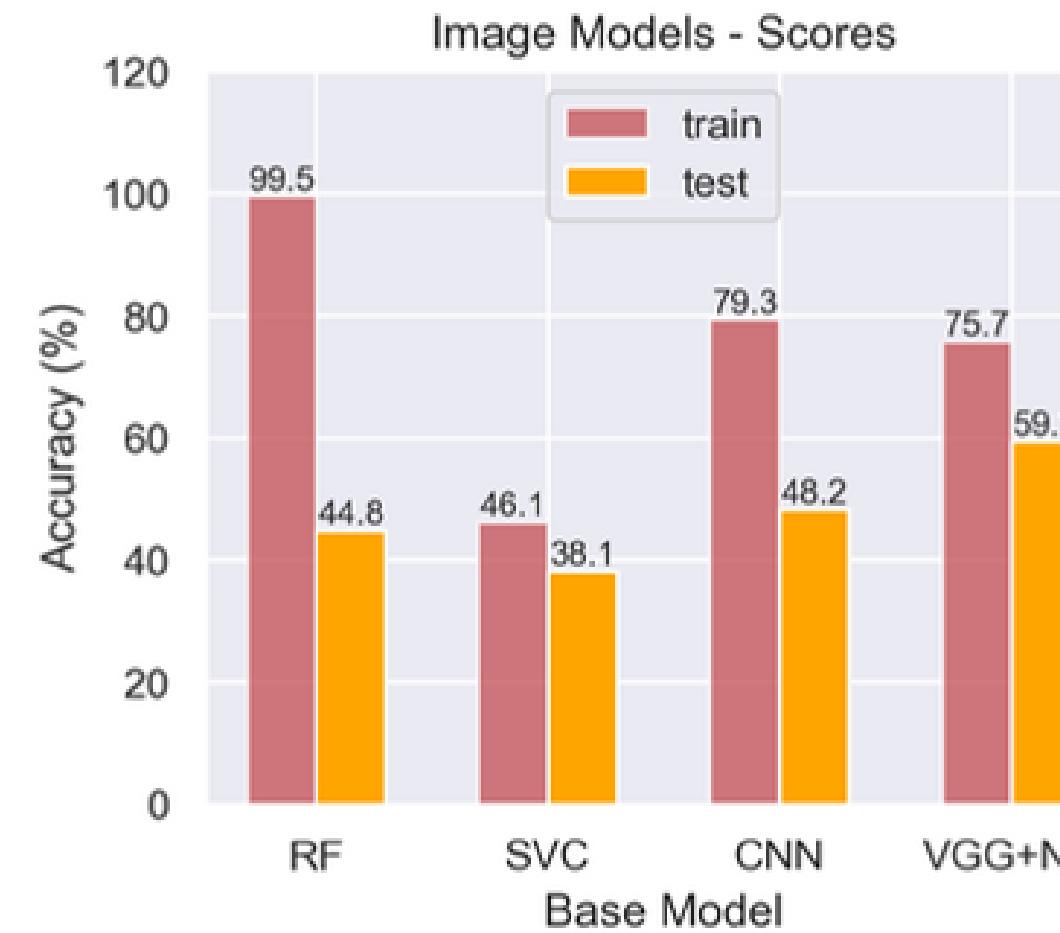
`flow_from_directory()`

****batch by batch****



1h30' / epoch

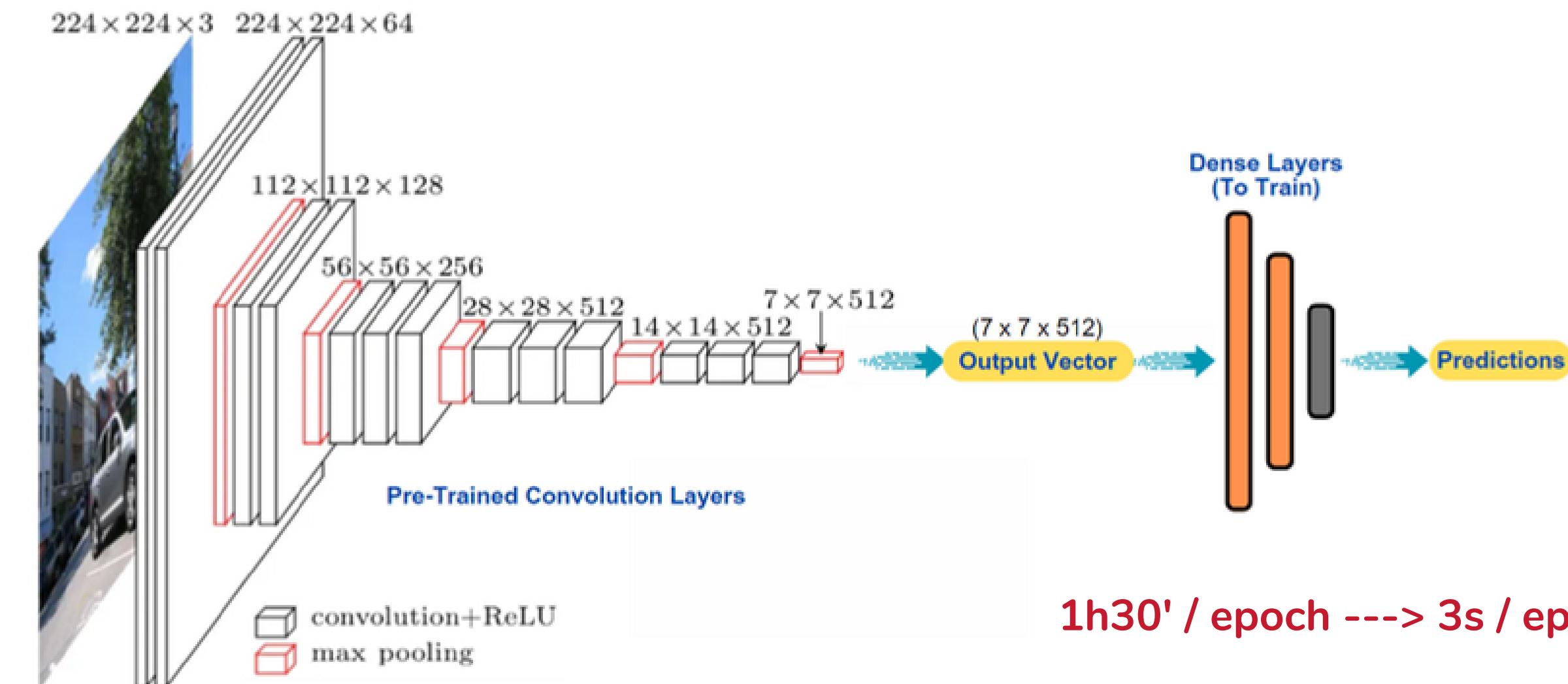
IMAGE BASE MODELS



Vgg16 + Neural Net.

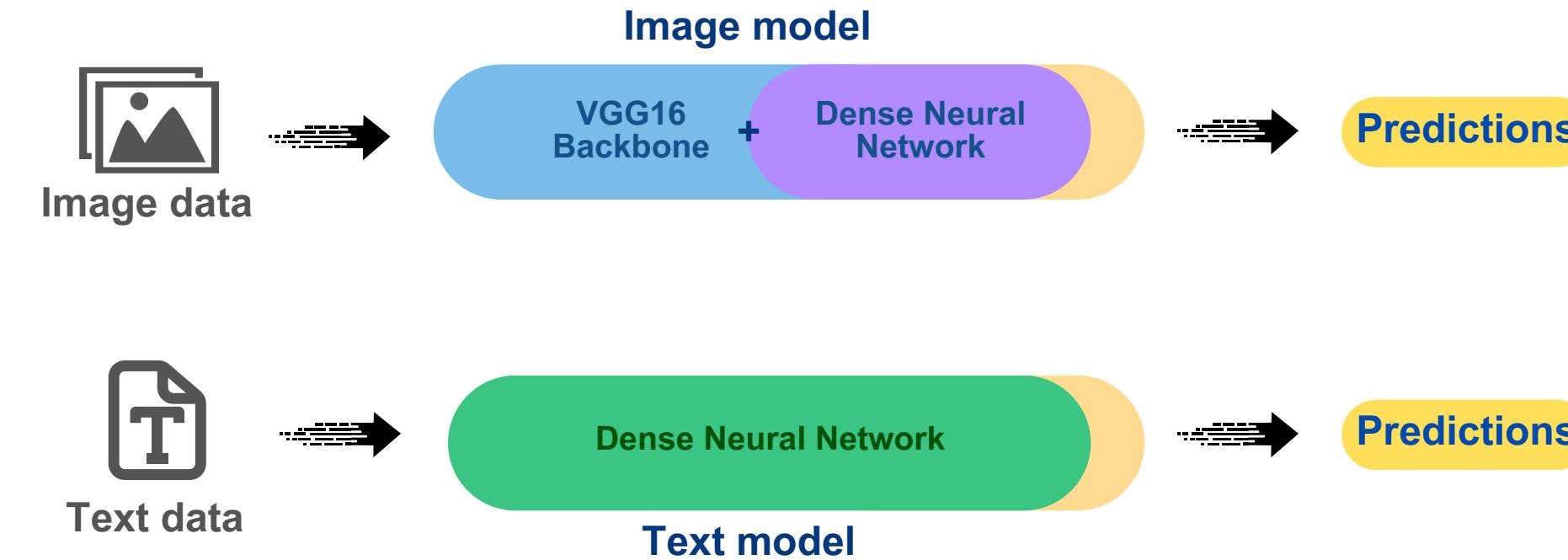
`flow_from_directory()`

****batch by batch****

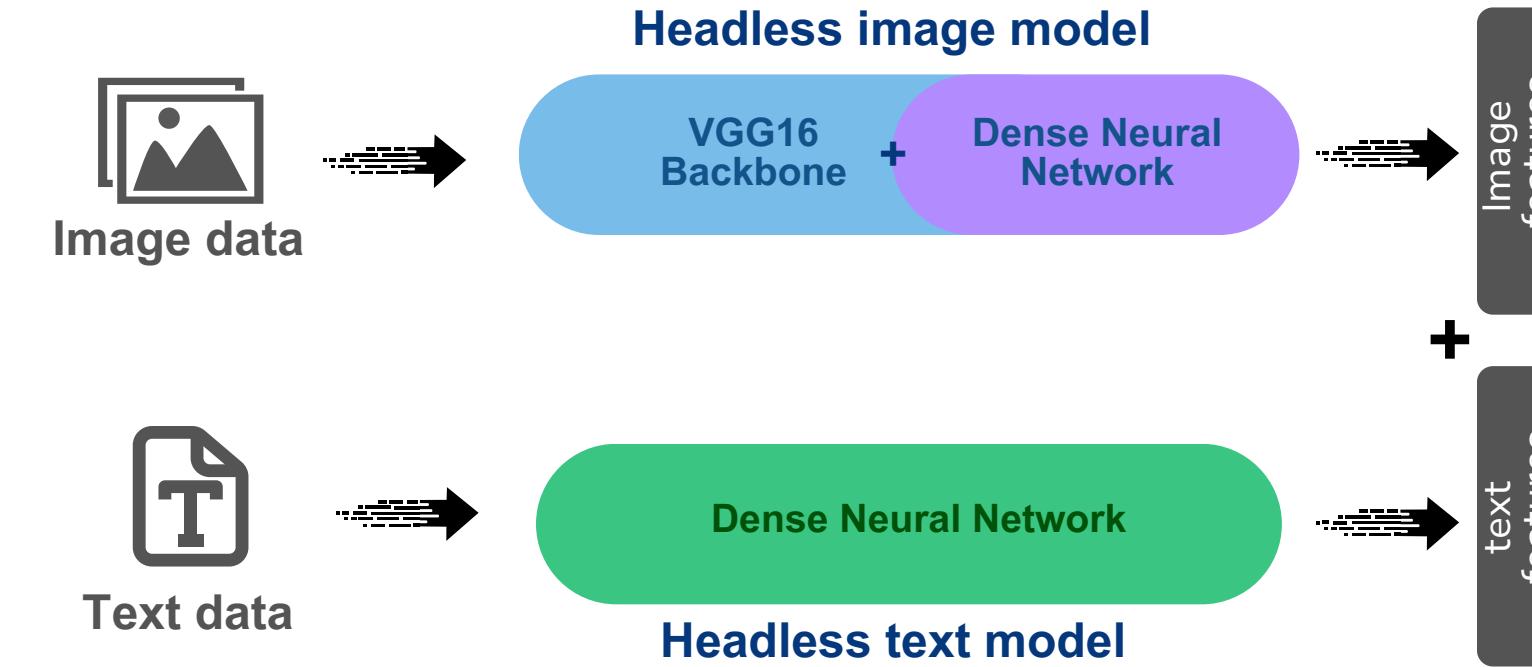


1h30' / epoch ---> 3s / epoch

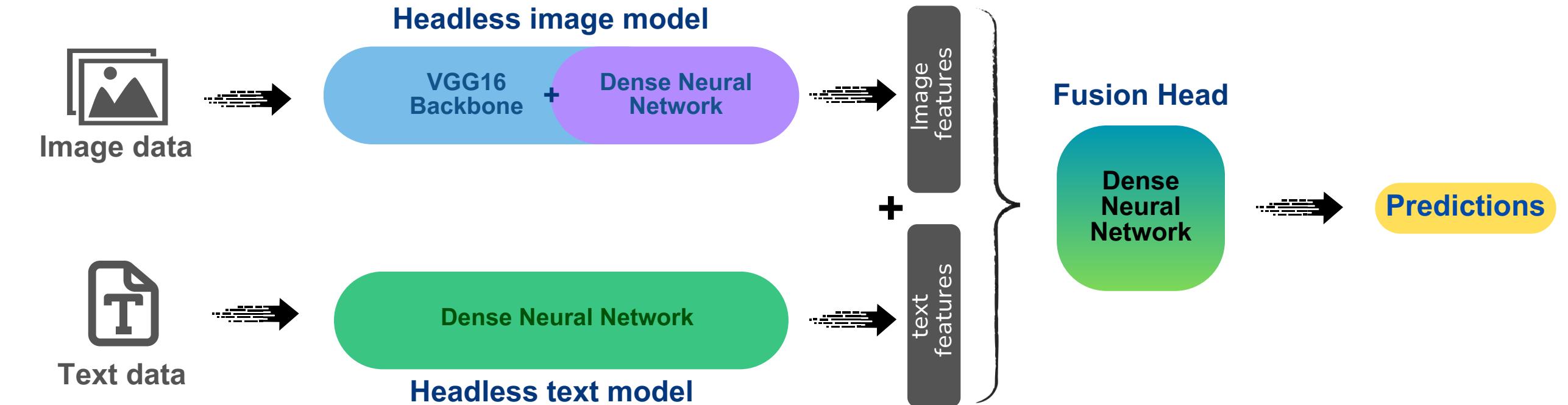
FUSION MODEL



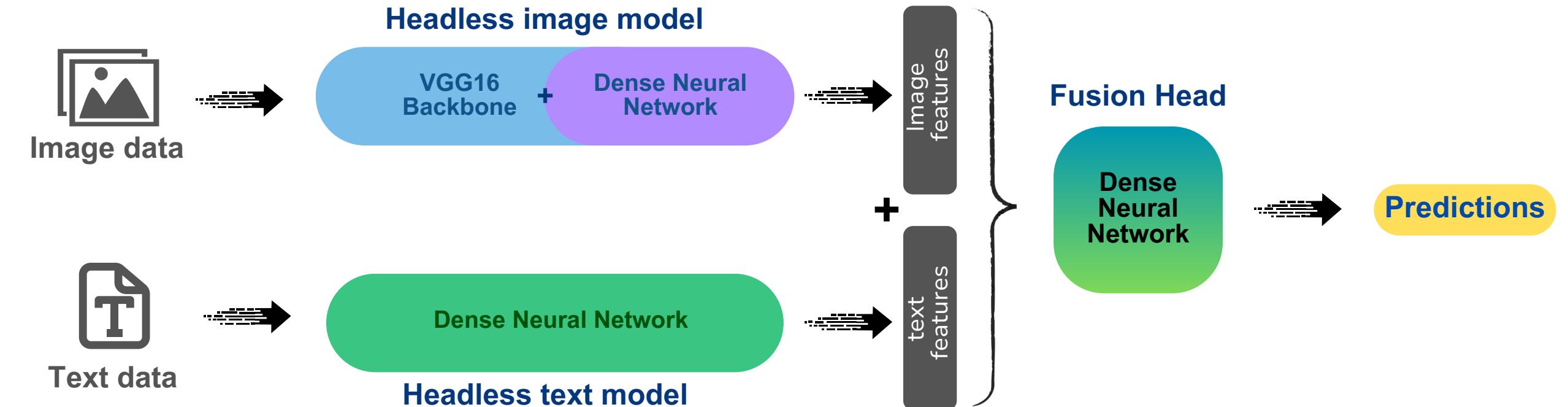
FUSION MODEL



FUSION MODEL



FUSION MODEL



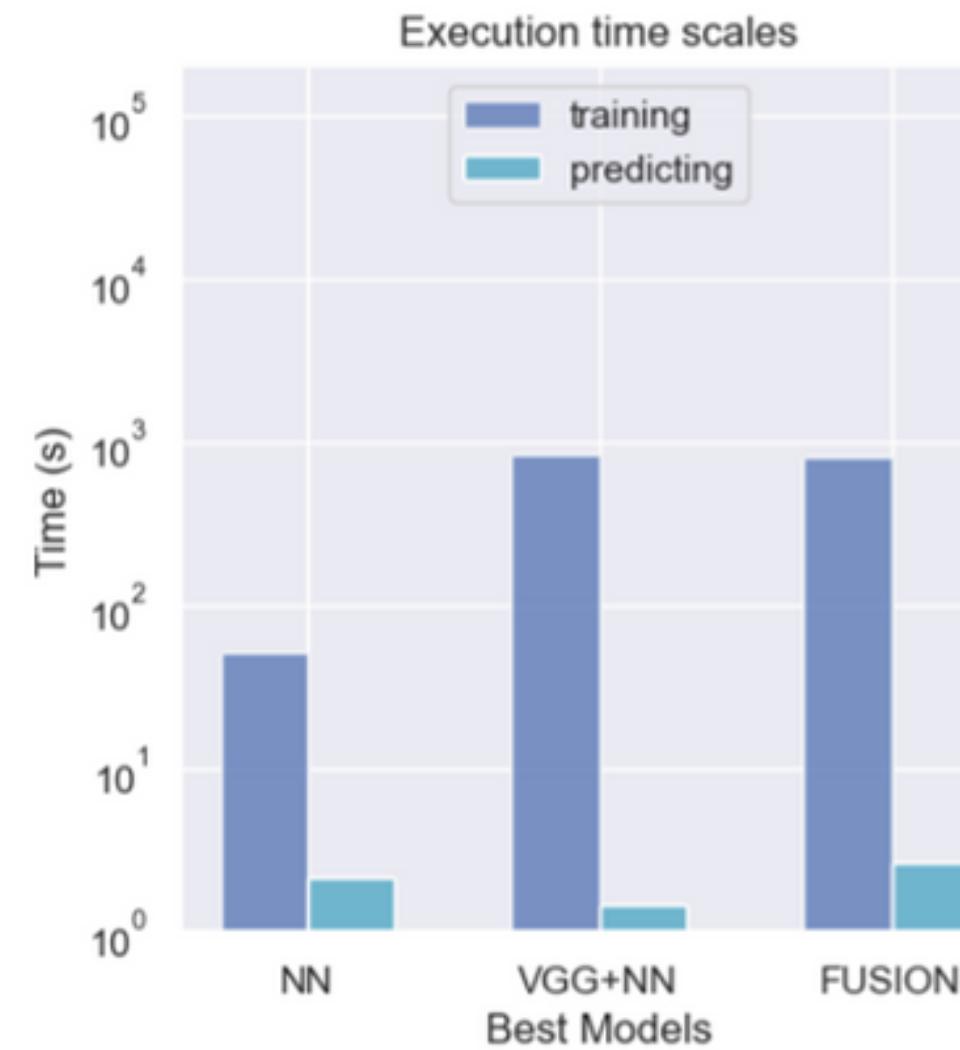
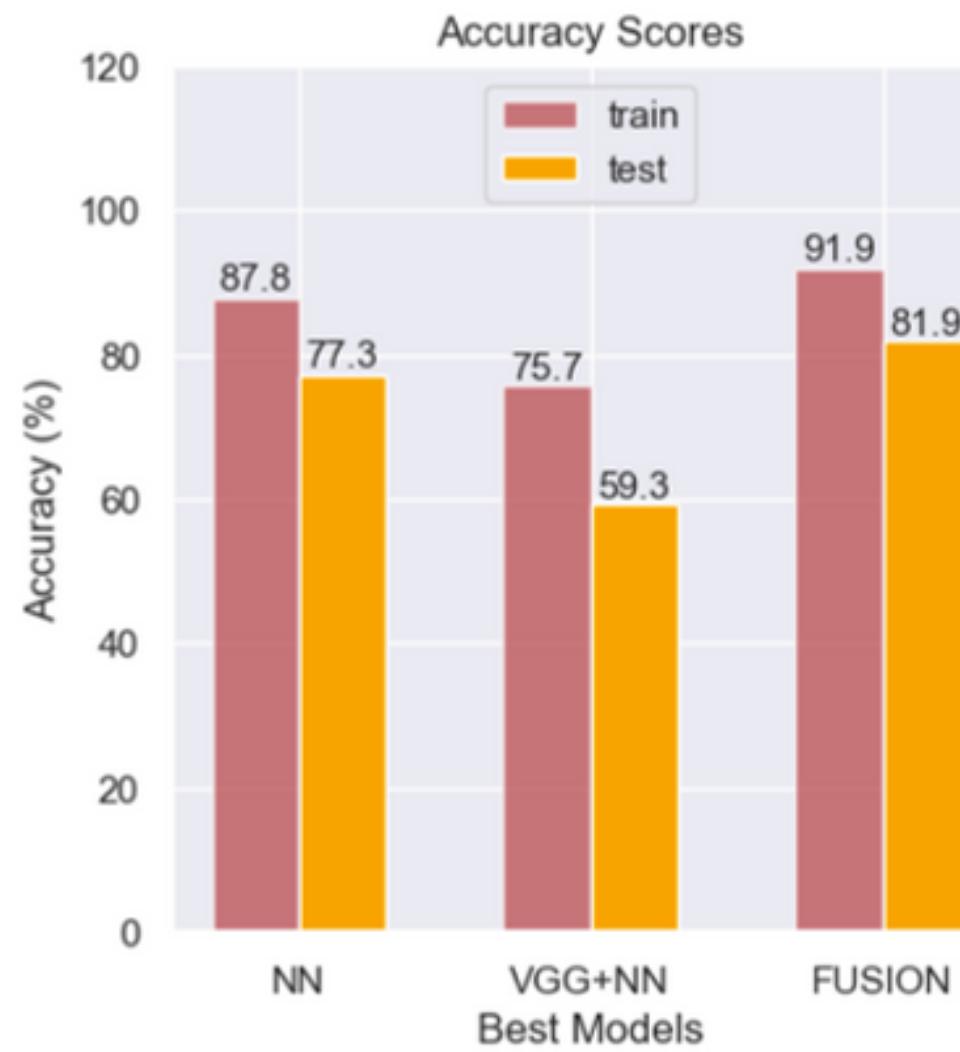
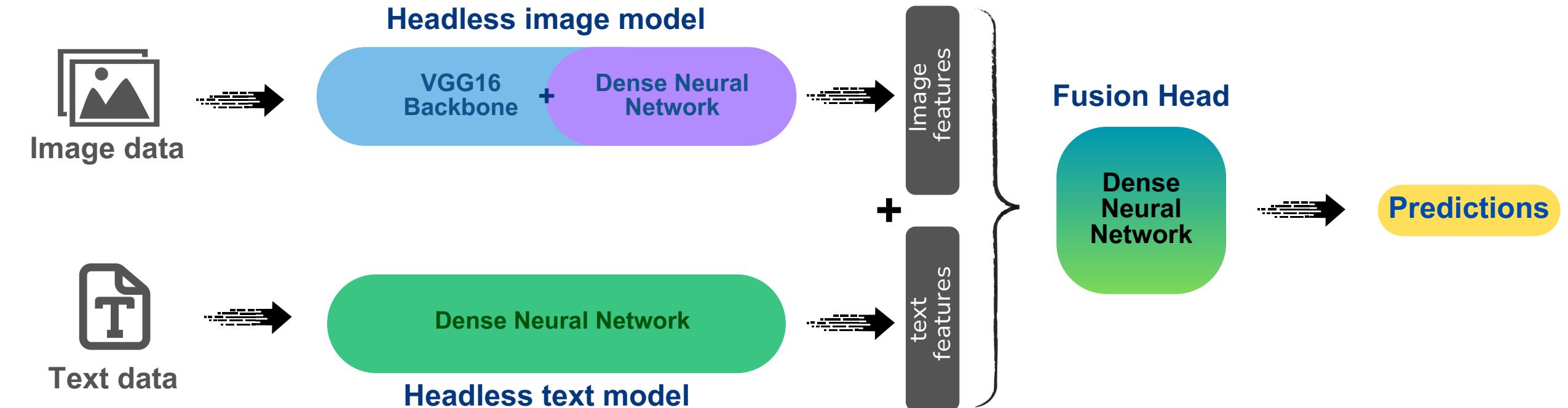
Layer	Output shape	Param #	Activation size
Input(shape = Nb_features)	(512)	0	512
BatchNormalization ()		2048	512
Dense(units = 1024, activation = 'relu')	1024	5231	1024
BatchNormalization ()	1024	4096	1024
Dropout(rate = 0.25)	1024	0	1024
Dense(units = 1024, activation = 'relu')	1024	1049600	1024
BatchNormalization ()	1024	4096	1024
Dropout(rate = 0.50)	1024	0	1024
Output_layer = Dense(units = Nb_classes, activation = 'softmax')	27	27675	27

Total params: 1.612.827

Trainable params: 1.612.707

Non-trainable params: 5.120

FUSION MODEL



Layer	Output shape	Param #	Activation size
Input(shape = Nb_features)	(512)	0	512
BatchNormalization ()		2048	512
Dense(units = 1024, activation = 'relu')	1024	5231	1024
BatchNormalization ()	1024	4096	1024
Dropout(rate = 0.25)	1024	0	1024
Dense(units = 1024, activation = 'relu')	1024	1049600	1024
BatchNormalization ()	1024	4096	1024
Dropout(rate = 0.50)	1024	0	1024
Output_layer = Dense(units = Nb_classes, activation = 'softmax')	27	27675	27

Total params: 1.612.827
Trainable params: 1.612.707
Non-trainable params: 5.120

PERFORMANCE

Vgg16 + Neural Net.

Test Accuracy = 59.3 %

Train Accuracy = 75.7 %

Training time = 14 min

Prediction time = 2 s

10 :: ‘livres_adulte’

2403 : 'livres_jeunesse'

2280 : 'magazines'

2705 : 'livres_et_illustres'



1280 : ‘jouets_enfance’

1281 : 'jeux_societe'

1300 : 'modeles_reduits_ou_telecomabdes'

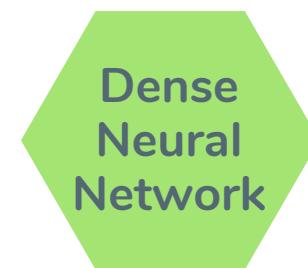
1302 : 'jouets_enfants'



Predictions

	10	40	50	60	1140	1160	1180	1280	1281	1300	1301	1302	1320	1560	1920	1940	2060	2220	2280	2403	2462	2522	2582	2583	2585	2705	2905
10	238	31	0	0	3	16	0	2	4	1	0	0	1	1	5	4	0	85	51	2	13	0	1	1	150	14	
40	14	296	13	9	8	7	0	5	9	22	2	5	2	2	1	0	8	1	24	24	12	7	0	5	4	6	16
50	2	9	111	18	9	2	2	9	2	47	0	14	6	11	1	2	6	0	0	11	12	19	1	29	11	2	0
60	0	7	9	112	2	0	0	3	4	8	0	0	0	1	0	0	0	0	0	2	2	9	0	6	0	1	0
1140	2	16	3	0	327	12	11	62	6	10	1	4	7	0	2	3	17	0	7	17	10	2	2	6	2	3	2
1160	4	10	0	0	5	712	2	2	8	2	0	1	2	0	0	0	3	0	6	16	8	1	1	2	1	3	2
1180	8	4	1	0	19	6	45	16	9	3	1	0	4	3	1	0	8	0	7	10	1	1	0	3	0	1	2
1280	3	18	5	5	72	5	3	415	24	149	4	47	34	19	12	2	46	6	4	10	3	19	11	44	10	3	1
1281	9	22	6	6	17	19	6	75	82	14	1	7	9	5	5	3	14	2	19	36	8	19	1	17	5	4	3
1300	2	6	12	10	9	0	2	44	3	739	1	23	10	12	3	1	24	2	1	5	6	17	4	47	25	0	1
1301	0	2	1	1	1	1	0	10	3	1	83	6	5	3	5	2	5	1	1	2	1	12	1	10	3	0	1
1302	2	3	6	1	7	4	2	69	8	26	1	202	24	14	5	1	33	2	0	2	0	9	8	54	15	0	0
1320	3	2	7	5	3	0	0	57	3	15	3	23	271	57	29	5	37	5	3	7	1	34	15	55	7	1	0
1560	1	1	5	2	0	1	0	22	0	24	5	14	41	556	51	1	94	2	3	11	6	32	43	72	28	0	0
1920	4	2	1	0	6	0	0	10	3	8	3	2	16	41	662	0	44	3	1	11	2	19	6	10	7	0	0
1940	2	5	0	1	3	0	0	3	2	2	1	2	3	4	2	97	0	4	1	5	0	4	1	16	3	0	0
2060	4	5	6	5	19	2	1	64	12	32	4	18	31	68	58	1	490	2	3	13	2	37	28	69	20	3	2
2220	0	3	4	0	2	0	0	21	1	7	2	9	10	11	5	0	12	35	2	3	1	5	3	21	8	0	0
2280	67	39	0	0	0	7	2	3	0	1	0	0	0	0	1	2	1	0	700	76	5	3	0	2	0	36	7
2403	84	24	3	0	9	12	3	3	3	1	0	2	3	4	3	1	7	0	127	559	31	28	0	1	0	38	9
2462	2	18	5	11	8	8	0	2	6	12	0	1	1	1	2	0	7	0	3	47	134	7	1	3	1	0	4
2522	12	5	6	7	6	1	1	13	14	32	4	18	11	26	17	3	23	0	6	32	9	674	8	47	18	4	1
2582	0	0	3	0	3	0	0	9	1	13	6	12	26	88	15	3	51	3	3	2	0	20	149	85	24	2	0
2583	1	2	10	6	7	1	2	18	0	34	3	21	24	36	9	7	22	0	2	8	9	29	10	1756	23	2	0
2585	1	2	8	2	4	1	0	12	1	53	3	16	12	29	8	2	35	2	3	3	1	19	18	85	176	3	0
2705	91	12	0	1	4	3	0	2	3	1	0	0	2	0	1	1	2	0	31	11	0	4	0	0	0	378	5
2905	4	53	0	0	0	2	0	2	0	3	0	0	0	0	0	0	14	8	1	2	1	1	0	10	72		

PERFORMANCE



10 :: 'livres_adulte'
 2403 : 'livres_jeunesse'
 2280 : 'magazines'
 2705 : 'livres_et_illustres'



1280 : 'jouets_enfance'
 1281 : 'jeux_societe'
 1300 : 'modeles_reduits_ou_telecomabdes'
 1302 : 'jouets_enfants'



	Predictions																											
	10	40	50	60	1140	1160	1180	1280	1281	1300	1301	1302	1320	1560	1920	1940	2060	2220	2280	2403	2462	2522	2582	2583	2585	2705	2905	
Reality	304	22	0	0	9	25	4	6	4	4	0	1	3	0	0	1	3	3	96	86	1	5	1	3	2	40	0	
10	304	22	0	0	9	25	4	6	4	4	0	1	3	0	0	1	3	3	96	86	1	5	1	3	2	40	0	
40	54	285	20	0	14	16	7	13	12	4	0	2	2	0	0	1	2	0	32	9	17	2	0	1	1	6	2	
50	4	23	247	2	7	0	0	6	3	2	1	1	0	4	0	1	3	0	0	2	22	4	0	0	0	2	2	0
60	0	7	6	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	1
1140	20	9	1	1	413	10	4	28	5	2	0	2	8	0	1	1	4	0	7	8	2	4	0	1	0	3	0	
1160	77	14	1	0	13	628	3	6	8	4	0	2	0	0	0	0	2	0	13	10	0	2	1	1	2	4	0	
1180	17	12	1	0	15	11	50	12	9	4	0	3	2	1	0	0	2	0	2	4	3	2	0	1	0	2	0	
1280	10	15	4	0	54	5	1	681	52	39	3	36	19	2	2	0	12	1	12	10	0	12	0	1	2	1	0	
1281	18	11	1	1	6	12	14	93	187	2	0	9	1	1	2	1	6	0	10	1	7	9	1	4	2	15	0	
1300	22	6	1	0	7	4	4	28	0	897	0	2	4	0	0	1	3	0	16	5	0	7	0	0	2	0	0	
1301	0	2	0	0	1	0	0	4	6	0	138	2	2	0	0	0	0	1	2	1	1	0	1	0	0	0	0	
1302	7	2	0	0	2	2	1	37	5	3	3	380	9	3	2	0	3	1	5	2	1	4	5	16	5	0	0	
1320	23	1	1	0	9	4	1	29	8	5	1	9	474	13	19	2	22	0	2	3	0	12	4	3	2	1	0	
1560	1	0	0	0	0	1	0	5	0	0	0	1	10	828	29	0	64	0	1	0	0	12	32	3	28	0	0	
1920	2	0	0	0	0	0	0	5	0	0	1	1	7	21	786	0	28	1	0	0	0	2	6	1	0	0	0	
1940	5	0	0	0	0	2	1	3	0	0	0	0	4	1	0	123	3	0	7	4	0	3	1	2	1	1	0	
2060	4	0	2	0	5	1	1	16	1	2	1	6	15	47	33	0	805	1	7	2	0	14	18	4	14	0	0	
2220	2	1	1	0	0	0	0	9	0	0	0	1	4	2	1	0	4	126	1	0	0	0	4	5	4	0	0	
2280	110	13	0	0	9	13	0	4	2	16	0	2	4	0	1	0	0	0	625	101	1	6	0	2	1	42	0	
2403	102	9	0	0	3	12	2	6	1	1	1	0	1	1	0	1	4	0	120	660	1	4	0	1	0	25	0	
2462	5	20	20	2	5	6	0	2	7	2	0	0	1	1	0	0	0	0	4	7	200	1	0	1	0	0	0	
2522	12	4	0	0	3	9	0	6	7	2	1	1	13	14	0	1	14	0	9	7	0	884	0	2	7	2	0	
2582	2	0	0	0	1	0	0	3	1	2	0	4	6	44	11	0	35	4	0	0	0	4	354	14	31	2	0	
2583	4	0	0	0	1	0	0	2	0	1	1	5	4	4	0	0	8	0	0	1	0	5	7	1982	16	1	0	
2585	0	1	5	0	1	4	0	6	0	1	2	4	6	11	0	0	22	0	0	1	0	8	10	22	393	2	0	
2705	84	10	0	1	1	3	1	2	3	0	0	0	5	0	0	0	1	2	51	35	0	0	2	0	1	3	347	0
2905	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	171	0

1160 : 'cartes_a_jouer'
 40 :: 'jeux_videos_import'
 10 :: 'livres_adulte'

PERFORMANCE

Fusion

10 :: 'livres_adulte'
 2403 : 'livres_jeunesse'
 2280 : 'magazines'
 2705 : 'livres_et_illustres'



1280 : 'jouets_enfance'
 1281 : 'jeux_societe'
 1300 : 'modeles_reduits_ou_telecomabdes'
 1302 : 'jouets_enfants'



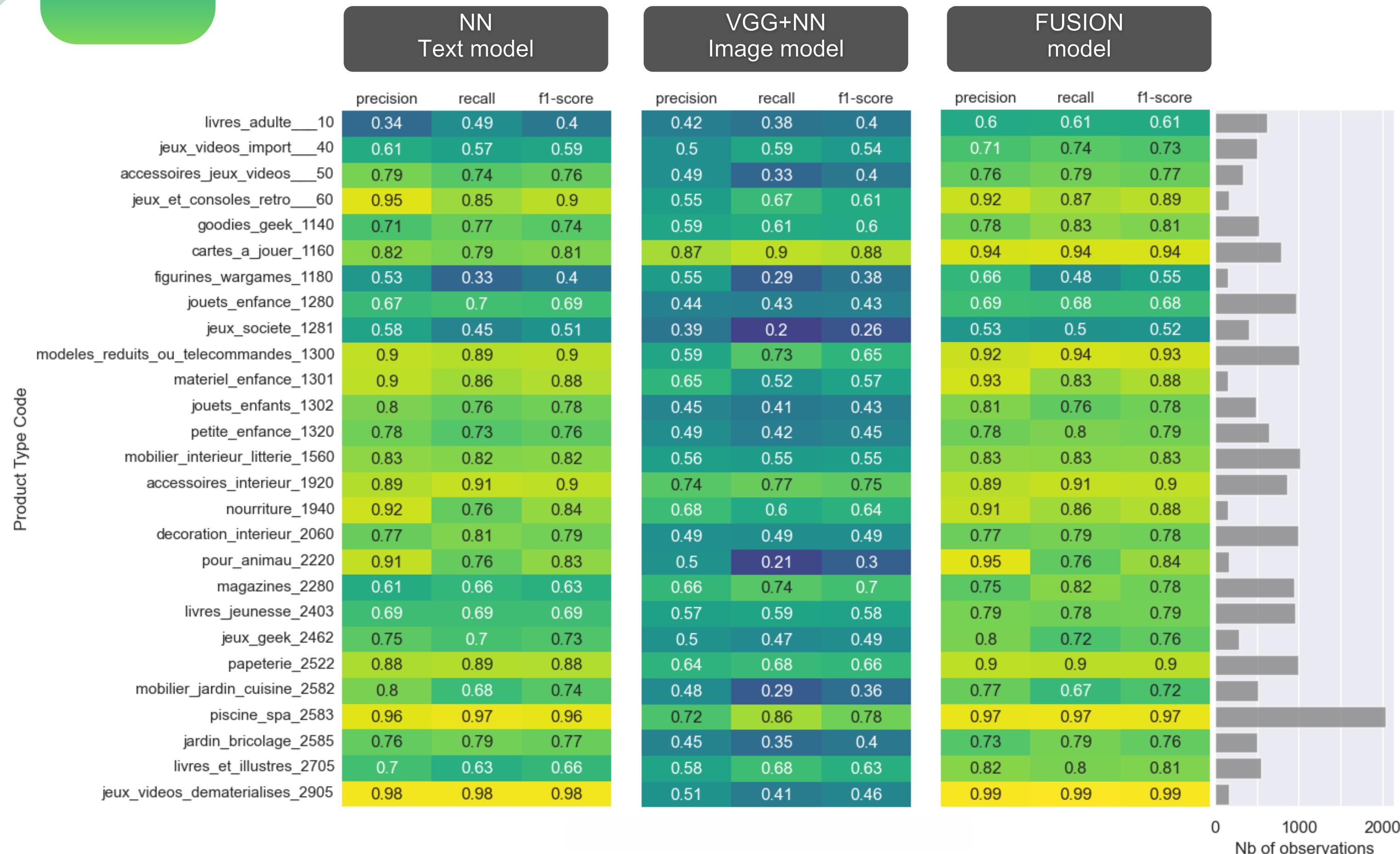
	Predictions																											
	10	40	50	60	1140	1160	1180	1280	1281	1300	1301	1302	1320	1560	1920	1940	2060	2220	2280	2403	2462	2522	2582	2583	2585	2705	2905	
Reality	381	14	0	0	3	4	3	3	3	2	0	1	1	0	0	0	0	0	0	87	57	0	4	0	0	1	59	0
10	381	14	0	0	3	4	3	3	3	2	0	1	1	0	0	0	0	0	0	19	8	18	2	0	1	1	4	1
40	13	372	25	0	4	5	1	7	14	2	0	2	2	0	0	0	1	0	0	19	8	18	2	0	1	1	4	1
50	0	15	264	3	6	0	1	4	1	3	1	0	3	4	0	1	3	0	0	1	18	4	0	0	0	3	1	0
60	0	9	7	144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
1140	1	5	3	0	444	2	9	27	6	6	0	4	7	0	1	1	5	0	3	5	2	1	0	1	1	0	0	
1160	8	6	0	0	5	744	0	2	12	2	0	0	0	0	0	0	0	0	7	4	0	0	0	0	0	1	0	
1180	5	6	4	0	13	5	73	9	19	1	0	2	2	0	0	0	1	0	2	6	0	3	1	1	0	0	0	
1280	3	14	8	0	54	2	2	663	75	46	1	32	27	2	2	0	20	1	3	1	0	8	2	2	6	0	0	
1281	3	19	2	1	9	13	13	88	208	2	0	11	2	1	0	0	3	0	2	9	5	12	1	4	3	3	0	
1300	0	2	1	0	4	0	2	33	0	944	0	1	0	1	0	0	7	0	1	4	1	6	0	0	2	0	0	
1301	0	2	0	0	0	1	2	3	5	0	134	3	4	0	0	1	2	0	0	0	1	0	1	1	0	1	0	
1302	1	1	1	0	2	1	1	46	8	3	3	377	17	2	2	0	4	0	1	3	0	2	4	14	5	0	0	
1320	1	1	1	0	3	0	0	28	8	1	2	7	520	13	17	3	19	0	0	2	0	9	6	5	2	0	0	
1560	0	0	2	0	1	0	0	2	0	1	0	1	9	839	27	0	56	1	1	0	0	10	32	1	32	0	0	
1920	2	0	0	0	0	0	0	4	0	1	0	0	11	18	785	1	27	0	1	1	0	2	6	1	1	0	0	
1940	0	0	0	0	0	0	1	3	1	0	0	0	7	2	0	138	1	0	1	0	0	3	0	3	1	0	0	
2060	1	1	3	0	6	3	1	16	3	1	1	6	17	57	32	0	791	1	1	1	0	10	22	2	23	0	0	
2220	0	1	0	0	0	0	0	3	3	2	0	0	2	2	1	2	8	125	0	1	0	1	4	4	6	0	0	
2280	67	18	0	0	1	3	0	0	1	2	0	1	1	0	0	1	0	0	780	62	0	2	0	0	0	13	0	
2403	61	12	0	0	1	3	2	1	2	1	0	0	0	0	0	0	3	0	105	748	1	3	0	0	0	12	0	
2462	1	20	19	8	5	4	0	3	6	2	0	0	0	1	0	0	0	0	1	8	204	1	0	0	0	1	0	
2522	7	3	1	1	1	3	0	8	10	2	0	2	12	13	0	2	7	0	6	8	0	896	4	3	8	1	0	
2582	1	0	0	0	2	0	0	4	1	1	1	3	10	44	11	1	38	3	1	1	0	3	348	10	33	2	0	
2583	1	1	0	0	1	1	0	4	0	1	0	8	5	2	0	0	5	0	0	1	0	5	8	1984	15	0	0	
2585	0	0	7	0	1	0	0	4	1	3	1	5	8	10	0	1	21	0	0	0	0	9	16	17	395	0	0	
2705	75	2	0	0	0	1	0	1	2	0	0	0	0	0	0	0	0	0	19	11	0	0	0	1	0	440	0	
2905	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	173	

1160 : 'cartes_a_jouer'
 40 :: 'jeux_videos_import'



PERFORMANCE

Fusion



CONCLUSION

FUSION MODEL

- ✓ Efficiently captures text & Image features.
- ✓ Performance superior to its component models.
- ✓ Efficient handling of memory resources.
- ✓ It can be run in a CPU reasonable fast.

- ✓ It can predict at a rate of 6300 items per seconds.
----> Potentially a good candidate for “online” deployment.

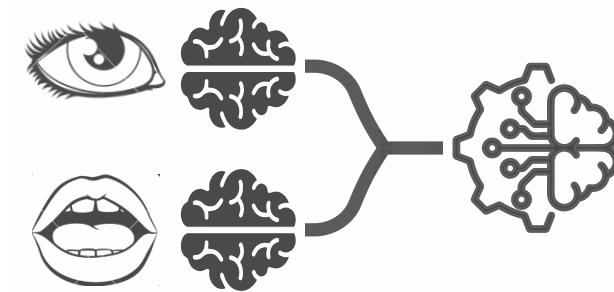
- ✓ It helps to distinguish better some subcategories, but there is room for improvement.

- ✓ Valuable asset to enhance the user experience.

To explore

- How does the model face non conforming data?
----> Trained with data augmentation.
----> Evaluate performance on items in other languages than FR or EN.

DEMO SHOW



THANKS FOR YOUR ATTENTION

