ArXiv Text Classification with PySpark

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Intro: What is arXiv?

“arXiv is a free distribution service and an open-access archive for 1,989,034 scholarly articles in the fields of physics, mathematics, computer science, quantitative biology, quantitative finance, statistics, electrical engineering and systems science, and economics.”

Problem

Classify research papers into one of the following academic categories:

- Physics
- Astronomy
- Math
- Engineering
- Economics
- Computer Science
- Biology
- Finance
- Statistics

Framework: PySpark

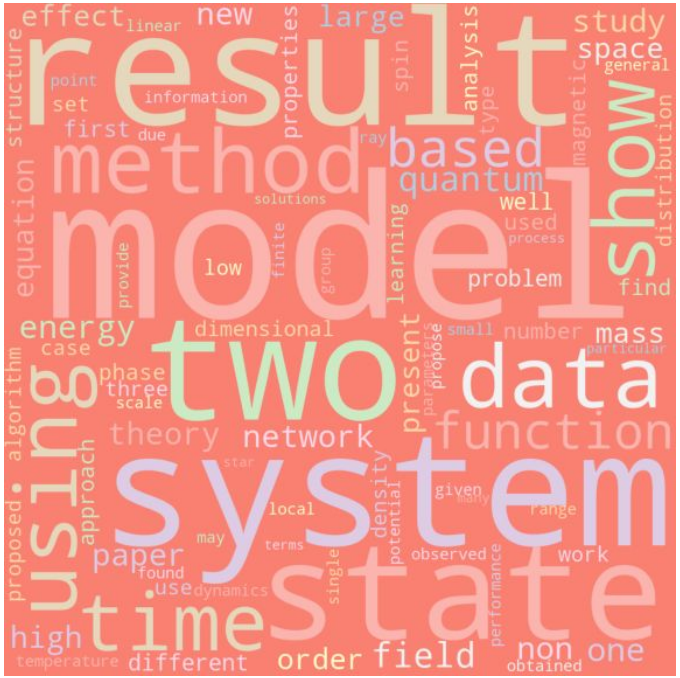
Data

- Metadata
- 1.7 Million rows
- 3.25 GB
- Features: authors, journal, categories, title, abstract, publishing date, etc.
- Used features: categories, title, abstract

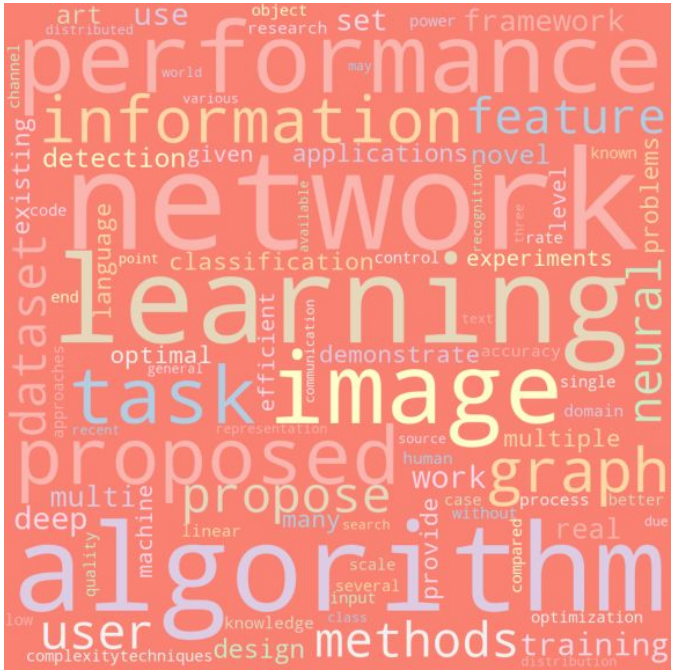
Data Exploration

category	count
PHYS	863455
MATH	436451
CS	320574
ASTRO	261725
STAT	35601
EESS	24893
BIO	23087
FIN	8838
ECON	3485

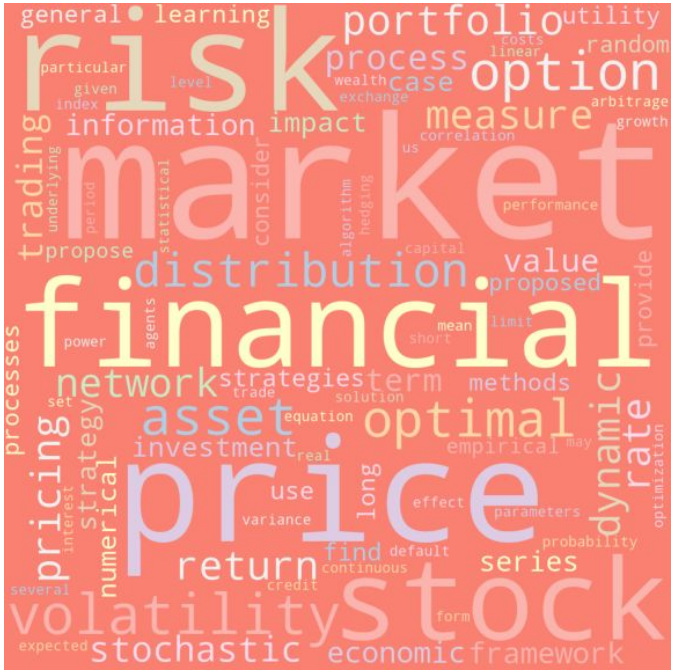
Most common words.



Data Exploration contd.



Computer Science



Finance

Baseline

Model: Multinomial Logistic Regression

Features prep:

- remove basic stopword (and, the, a, etc.)
- remove punctuation
- tokenize

Features: count vectors

Training subset size: 290, 987

Validation f1 score: 0.867

Experiments

Experiment type	F1 Score
Baseline: LR w/ Count Vectors	0.867
LR: Count Vectors w/ common words removed	0.864
LR: TFIDF	0.855
LR: Naive Bayes	0.846
LR: Balanced classes	0.828
Random Forest	0.301

Best Model

Validation Results

	precision	recall	f1-score	support
PHYS	0.91	0.95	0.93	181614
MATH	0.88	0.91	0.89	91576
CS	0.83	0.88	0.85	67249
ASTRO	0.96	0.89	0.93	54919
STAT	0.69	0.39	0.49	7479
EESS	0.52	0.11	0.18	5340
BIO	0.72	0.38	0.50	4748
FIN	0.72	0.40	0.51	1833
ECON	0.55	0.03	0.06	713
accuracy			0.89	415471
macro avg	0.75	0.55	0.59	415471
weighted avg	0.89	0.89	0.88	415471

Test Results

	precision	recall	f1-score	support
PHYS	0.91	0.95	0.93	258901
MATH	0.88	0.91	0.89	131055
CS	0.83	0.88	0.85	96214
ASTRO	0.96	0.89	0.93	78245
STAT	0.69	0.39	0.50	10877
EESS	0.55	0.12	0.20	7521
BIO	0.71	0.37	0.48	6934
FIN	0.72	0.39	0.50	2647
ECON	0.45	0.02	0.05	1048
accuracy			0.89	593442
macro avg	0.75	0.55	0.59	593442
weighted avg	0.89	0.89	0.88	593442