What's Cooking

All Eatable

CS 412 : Introduction to Machine Learning

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Project Description

- Kaggle
- Goal
  - use recipe ingredients to predict the cuisine
- Data
  - Training data
    - 39774 recipes and 20 kinds of cuisines
    - Recipe id
    - type of cuisine
    - list of ingredients of each
  - Testing data
    - Recipe id
    - list of ingredients of each

Introduction

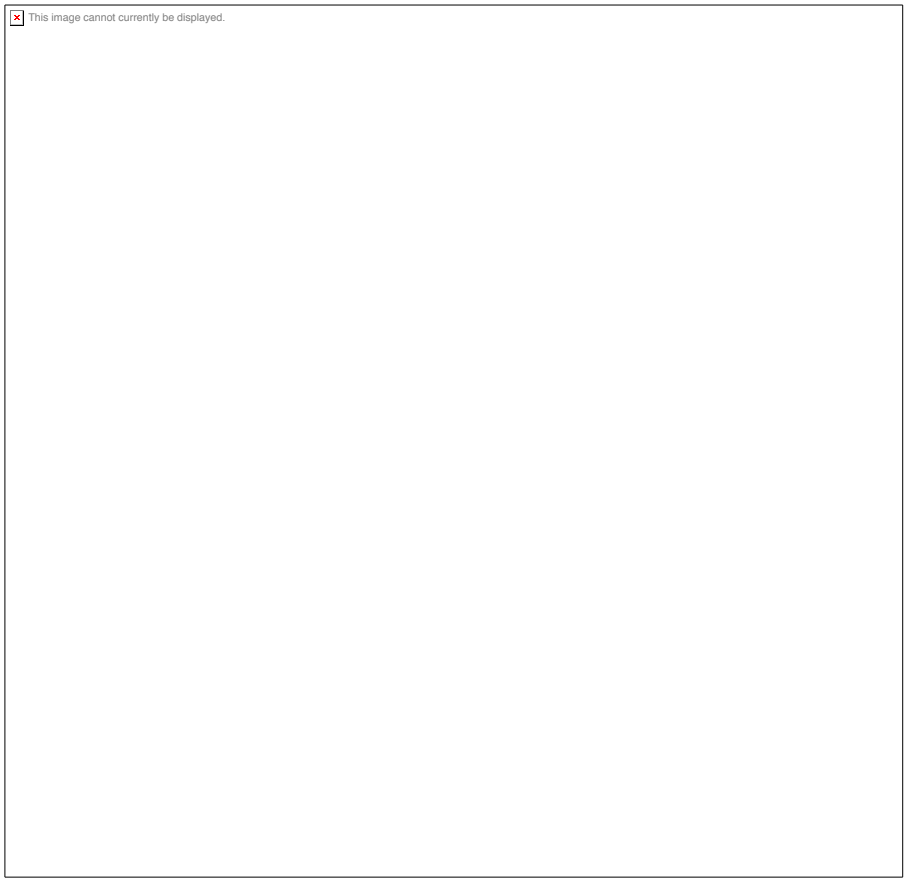
Italian (7838)

Mexican (6438)

Southern_US (4320)

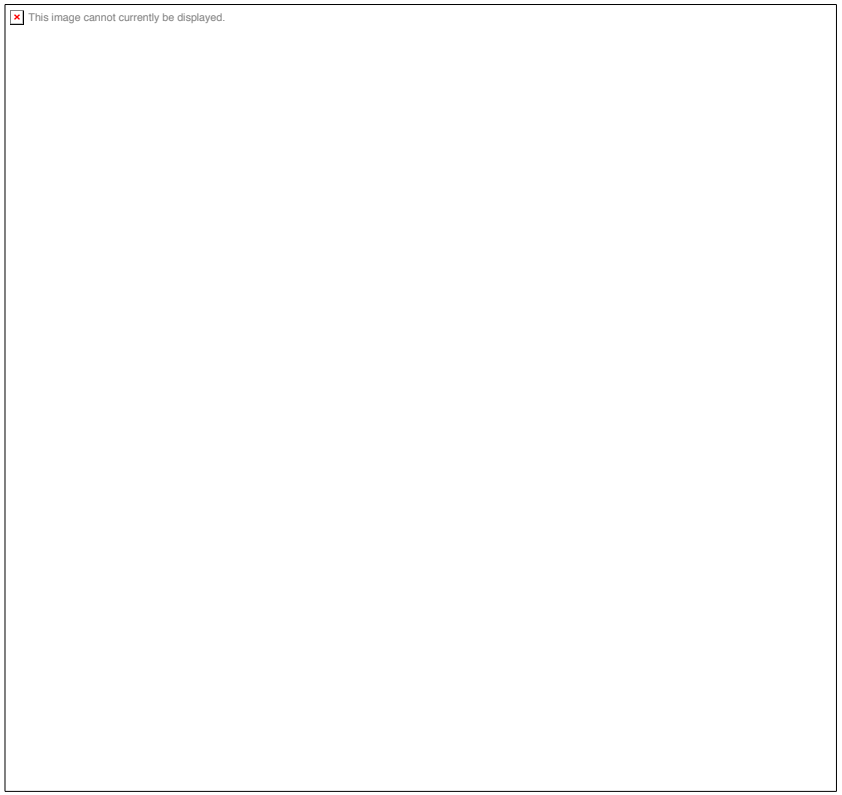
Introdution

- Using K-means Clusters to visualize training dataset
  - Tf-idf : each term in gradients and cuisine as documents
  - PCA: reduced to 2-Dimensentions
  - K-means cluster: k = 5
  - Size of bubbles: Jaccard Similarity(one v.s the other cuisines in its cluster)



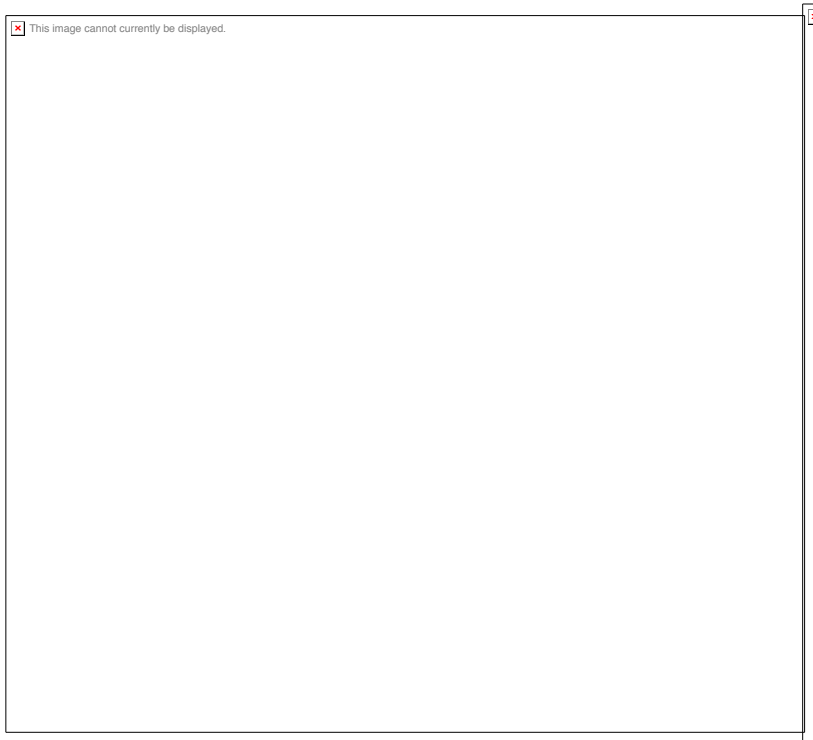
Introduction

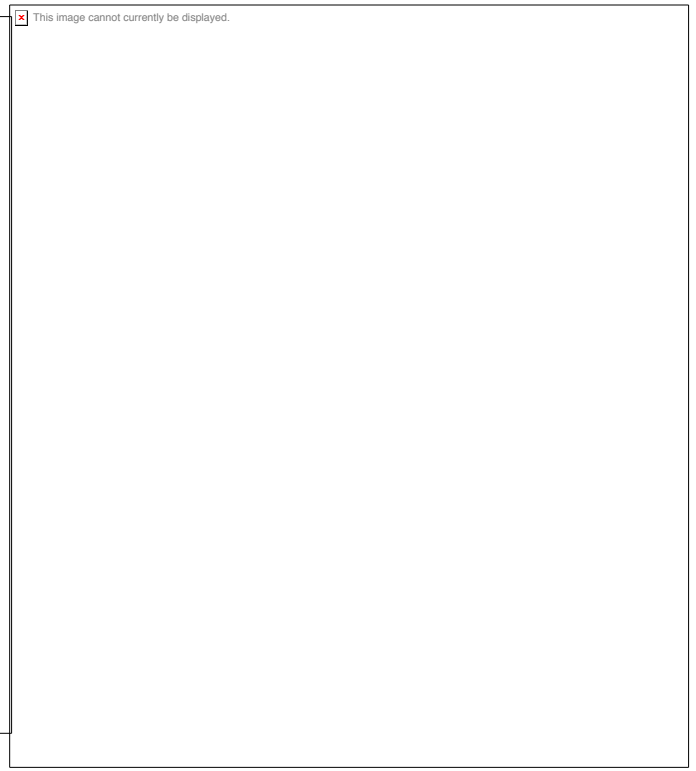
- Ingredients frequency more than 1000



Introduction

- Data representation
  - Focus on ***Italian*** cuisine to show its ingredient network
    - After removing stop-words, numbers and stemming



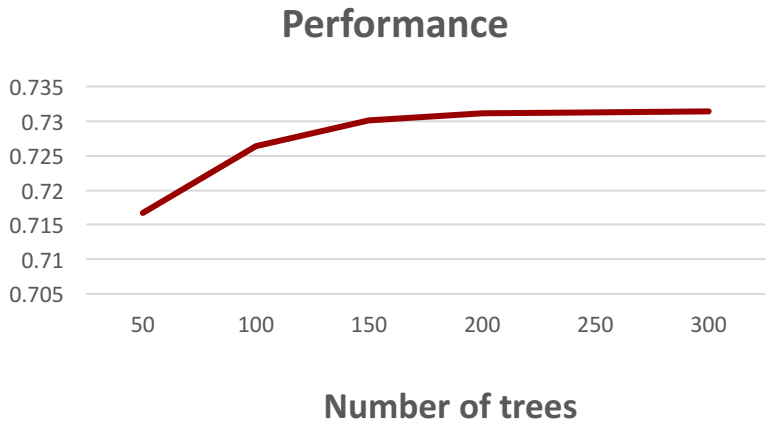


Methods

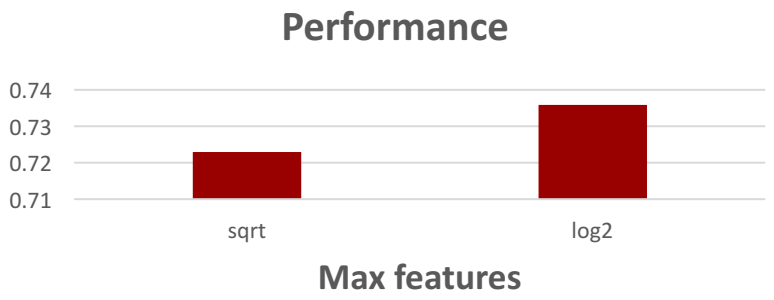
- Random Forest
- Naïve Bayes
- SVM
- LDA
- Neural Network

Random Forest

- Number of trees
  - Higher number of trees
    - Better performance
    - Lower speed

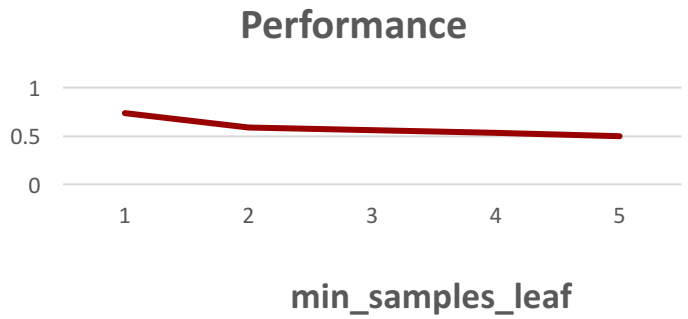


- Max_features
  - Sqrt -> sqrt(n_features)
  - Log2 -> log2(n_features)
  - None -> n_features

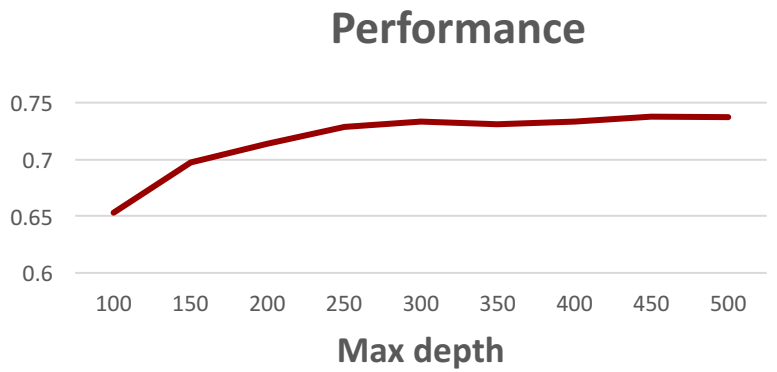


Random Forest

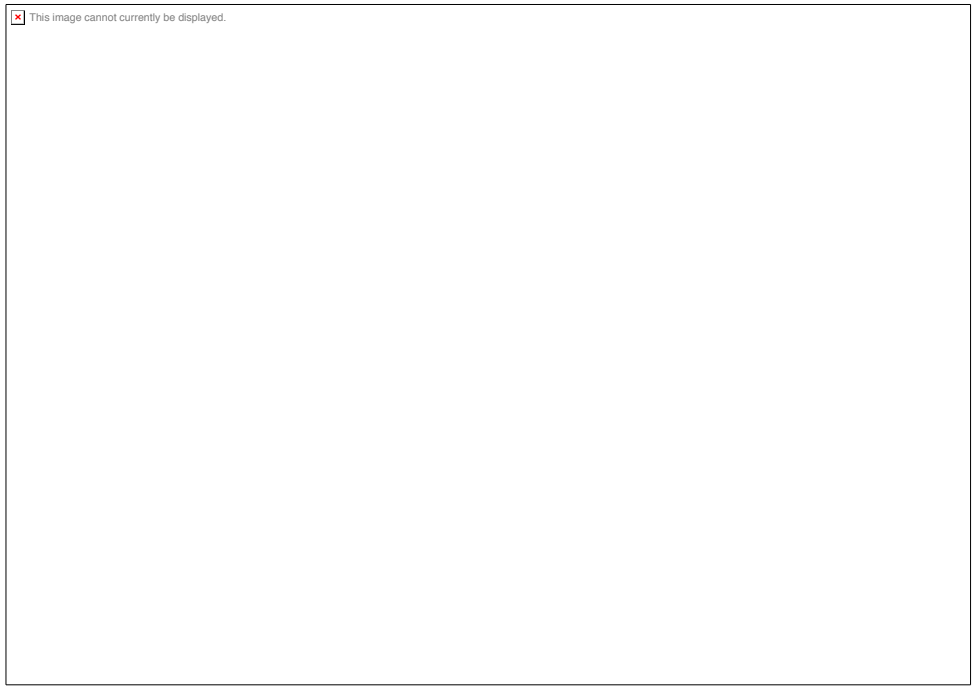
- Min samples leaf
  - The minimum number of samples
  - required to split an internal node



- max_depth
  - The maximum depth of the tree.
  - If None, then nodes are expanded until all leaves are pure or until all leaves contain less than min_samples_split sample



Naïve Bayes



Using 5-fold cross-validation to tune smoothing parameter alpha, we got alpha=0.125 to build model.

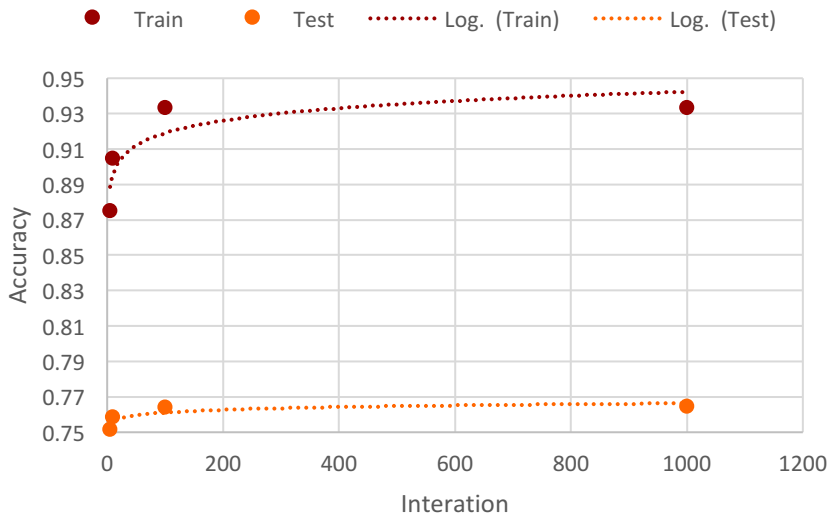
There are 20 classes and the areas of ROC curves are around 0.89 to 0.99.

	Accuracy	F-score(micro)	F-score(macro)
Train	0.826601	0.826601	0.788229
Test	0.762946	0.762946	0.685015

Linear SVM

- max_iter
  - The maximum number of iterations to be run

Max_Iter	Train	Test
5	0.874827153	0.751194368
10	0.904431175	0.758109127
100	0.933312382	0.764018104
1000	0.933123821	0.764395273



Linear SVM

- C: Penalty parameter C of the error term.

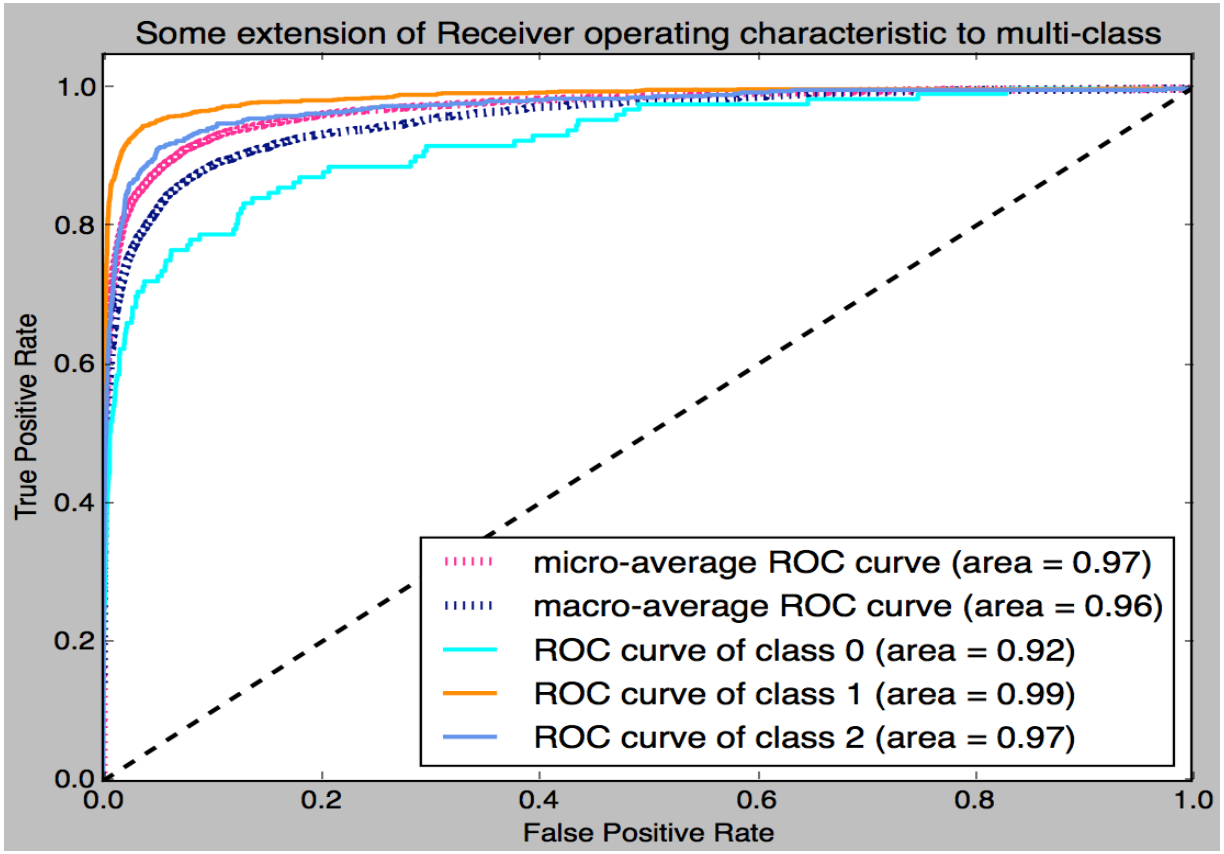
C	Train	Test
0.5	0.9221873	0.7738245
1	0.9331238	0.7643952
2	0.9403834	0.7523259

- Loss: ‘hinge’ or ‘squared_hinge’

loss	Train	Test
hing	0.9085167	0.7725672
squred_hing	0.9331238	0.7643953

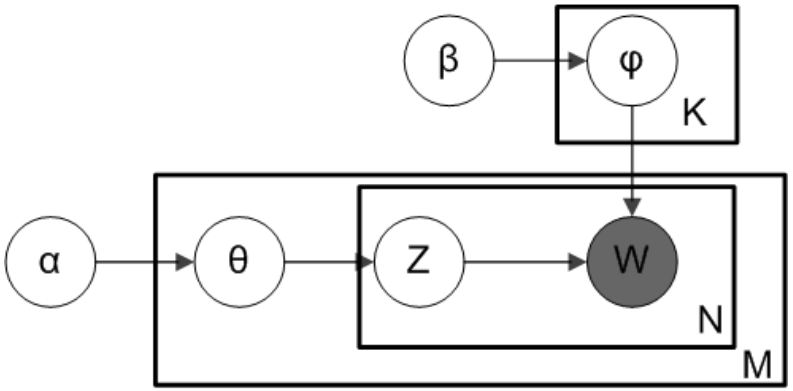
Linear SVM

- Roc Curve



Latent Dirichlet Allocation

Unsupervised learning



- Randomly generate the topic distribution θ_i of document i from dirichlet distribution with α
- Randomly sample the topic of word j in the document i $z_{i,j}$ from the topic polynomial distribution θ_i
- Dirichlet distribution with β to randomly generate the vocabulary distribution $\varphi_{z_{i,j}}$ of topic $z_{i,j}$
- From vocabulary with polynomial distribution $\varphi_{z_{i,j}}$ to randomly sample the final word $w_{i,j}$

LDA

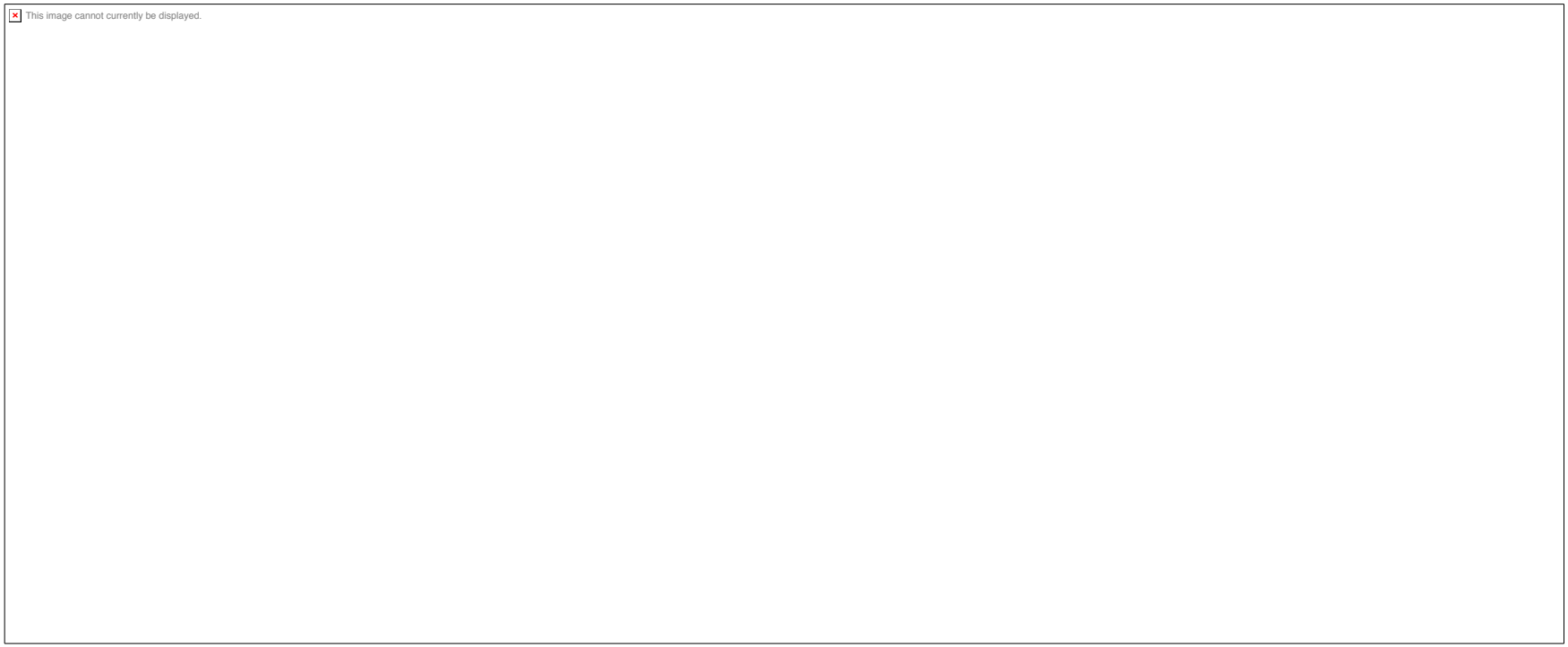
- Most probable words in four of the topics:

probability

Topic 0	Topic 5	Topic 9	Topic 14
Sour cream	salt	salt	butter
Chili powder	All-purpose flour	Garlic cloves	salt
salsa	Baking powder	Cooking spray	eggs
Black beans	sugar	Olive oil	sugar
Flour tortillas	Large eggs	Chopped onion	milk

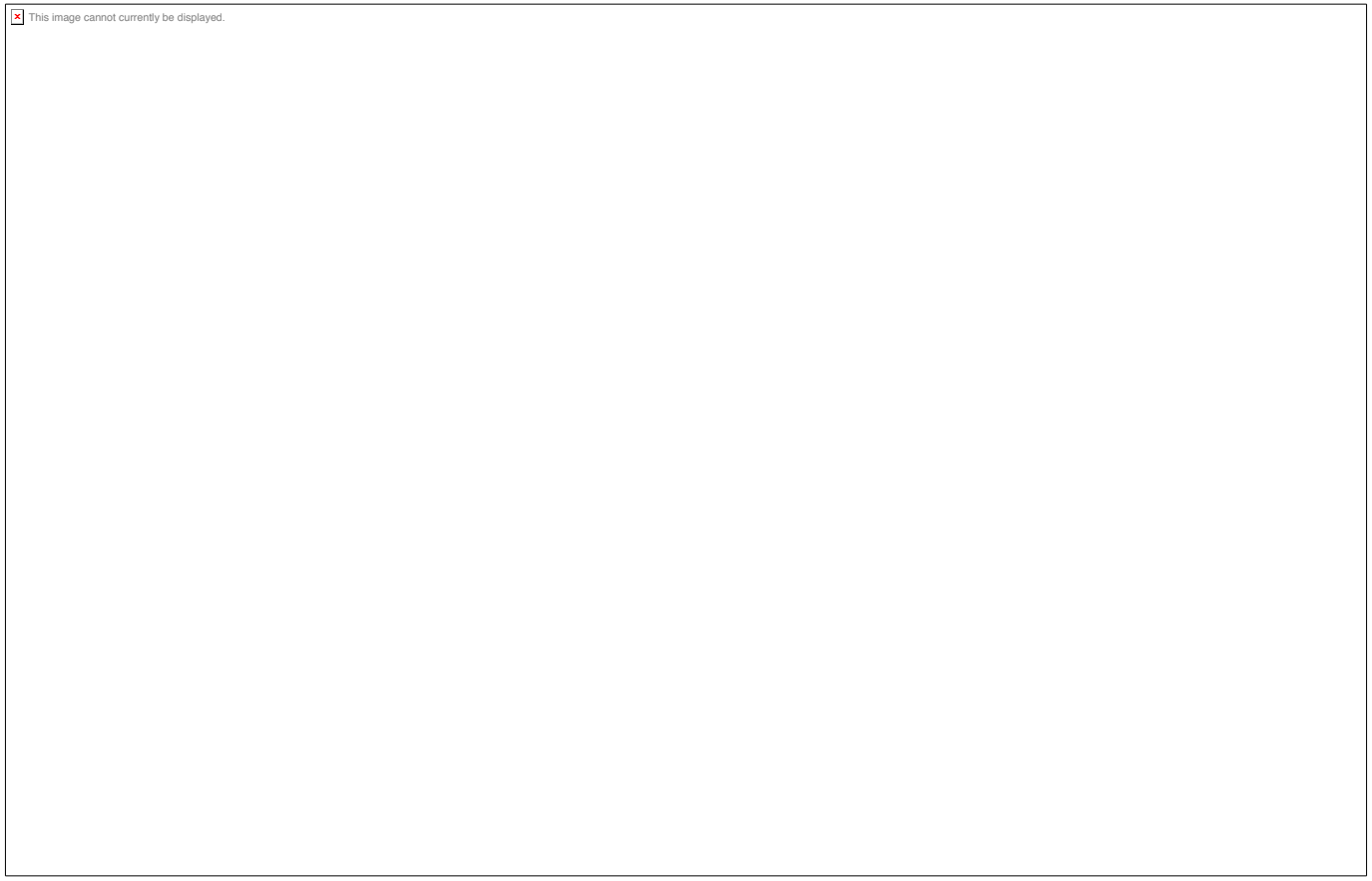
LDA

- Most probable words in four of the topics:



LDA

- Most probable topics in five of the docs:



LDA + KNN

- Unsupervised -> Supervised

Neural Network

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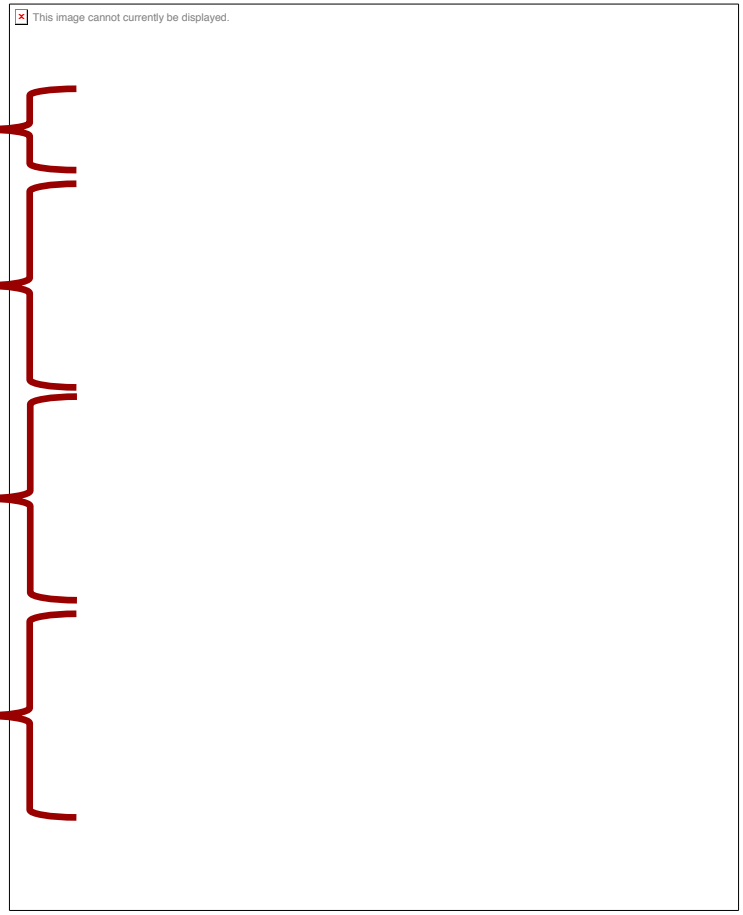


Results of Neural Network

Batch-norm with Dropout

	Accuracy	Loss
Train	0.987010	0.043150
Test	0.789090	1.269093

Results of Neural Network

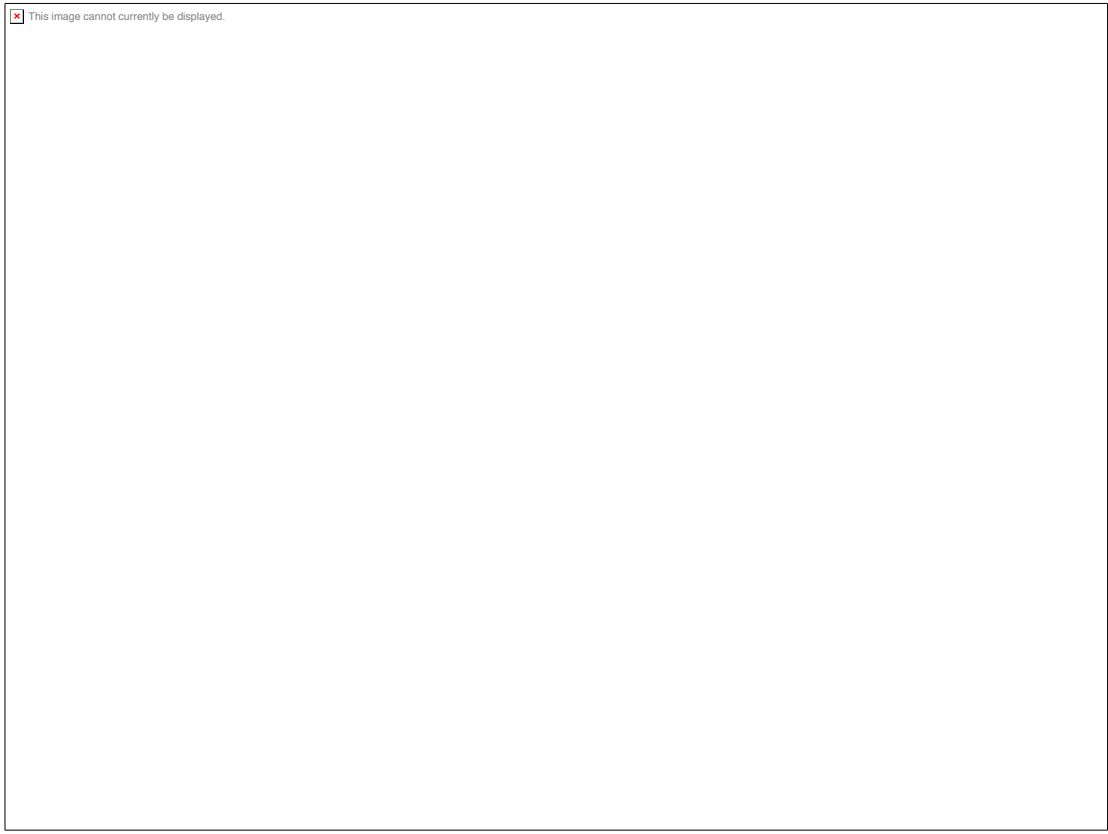
No Batch-norm but with Dropout

	Accuracy	Loss
Train	0.780003	0.726374
Test	0.741327	0.855012

Results of Neural Network

Batch-norm without Dropout

	Accuracy	Loss
Train	0.999609	0.001691
Test	0.754651	1.096316



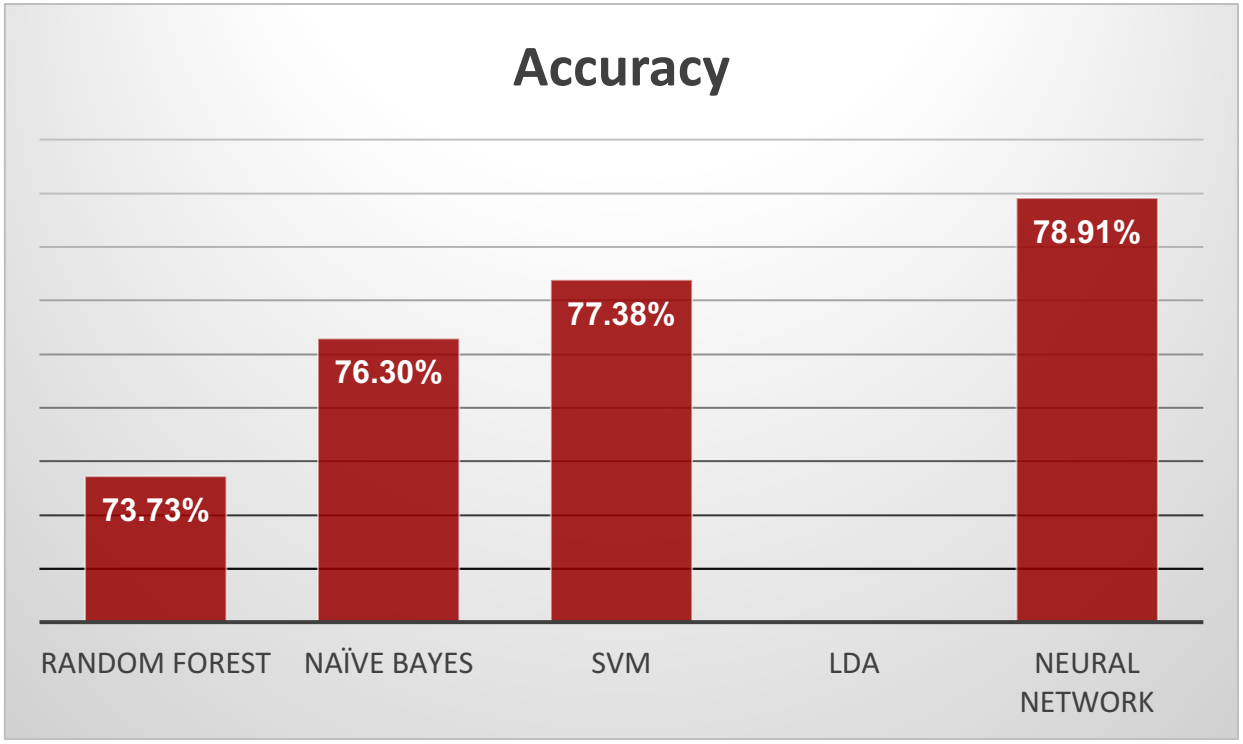
Comparison on the effects of Batch-norm and Dropout

Batch Normalization	Dropout	Train Accuracy	Test Accuracy
Yes	Yes	0.987010	**0.789090**
No	Yes	0.780003	0.741327
Yes	No	0.999609	0.754651
No	No	0.999497	0.746858

Batch-norm:
faster convergence

Dropout:
reduce over-fitting

Comparison


Accuracy
73.73%
76.30%
77.38%
78.91%
RANDOM FOREST
NAÏVE BAYES
SVM
LDA
NEURAL NETWORK

Fin

Thank you for your Attention