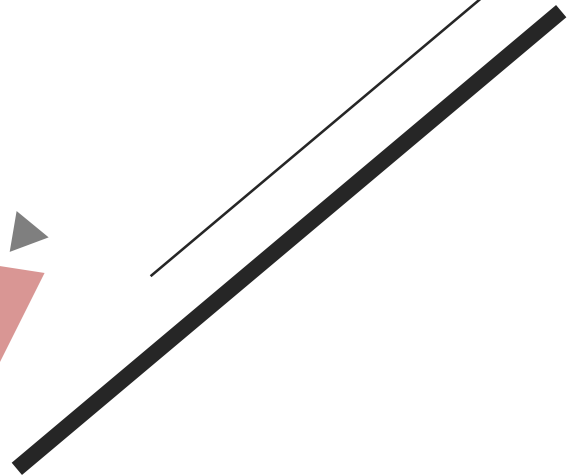


# Project 3: Dogs, Fried Chicken or Blueberry Muffins?



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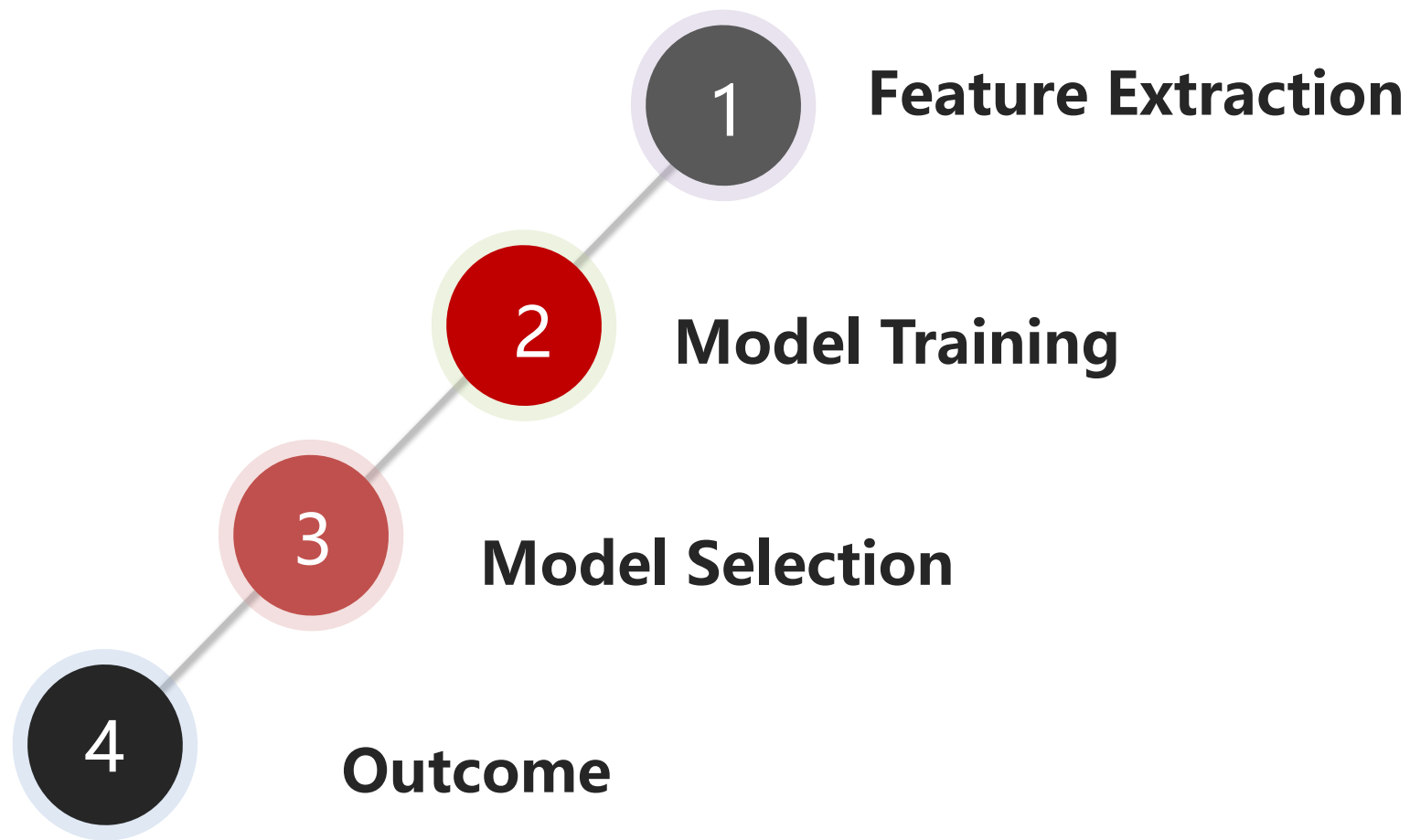


# Introduction

In this project, we have created a classification engine for images of poodles, fried chicken and blueberry muffins. Our goal is to improve the prediction accuracy from the baseline model (GBM with decision stumps on 2000 SIFT features) and to enhance computational efficiency in terms of running time, storage and memory cost.



# Outline



# 1

A cluster of five small triangles in light red, dark red, black, and grey, arranged in a circular pattern around the number 1.

PART

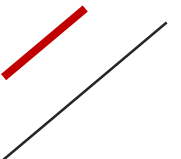
# Feature Extraction

Four diagonal lines of varying lengths and colors (black and red) scattered around the text.



## Feature extraction

### SIFT

- Baseline
  - A classical approach, local descriptor
  - Rotation and scale invariant
- 

### HOG

- Histogram of Oriented Gradients
- Global descriptor



### LBP

- Local Binary Patterns

# 2

A cluster of five small triangles: a large light red one pointing down-left, a small dark grey one pointing up-right, a small red one pointing up-right, a small dark grey one pointing up-right, and a small light grey one pointing up-right.

## PART

Model Training

Four diagonal lines: a thin black line above the 'M', a thick red line above the 'T', a thin red line below the 'g', and a thick black line below the 'M'.



# Models

[ 1 ]

Gradient Boosting Model (baseline)



[ 2 ]

Support Vector Machine (SVM)

[ 3 ]

Random Forest (RF)



[ 4 ]

Logistic Regression



[ 5 ]

Xgboost

[ 6 ]

Convolutional Neural Networks(CNN)



# 3

A cluster of five small triangles: a large light red one pointing down-left, a small dark grey one pointing up-right, a small red one pointing up-right, a small dark grey one pointing up-right, and a small light grey one pointing up-right.

## PART

Model selection

Four diagonal lines of varying lengths and colors: a thin black line, a medium red line, a long black line, and a medium red line.





## Tune parameter

```
run.sift = F  
run.hog = F  
run.lbp = F
```

```
run.gbm = F  
run.svm = F  
run.xgboost = F  
run.rf = F  
run.logistic = F
```

```
model_values <- seq(3, 11, 2) # depth for GBM  
# model_labels = paste("GBM with depth =", model_values)  
  
svm_values <- seq(0.01, 0.1, by = 0.02) # gamma for svm  
# svm_labels = paste("SVM with gamma =", svm_values)  
  
xgboost_values <- seq(0.1, 0.5, by = 0.1) # eta for xgboost  
# xgboost_labels = paste("XGBoost with eta =", xgboost_values)
```

## Tune parameter

```
> cv.result[[1]]
```

	depth = 3	depth = 5	depth = 7	depth = 9	depth = 11
hog_gbm	0.4213333	0.4126667	0.4090000	0.4013333	0.4193333
lbp_gbm	0.3670000	0.3520000	0.3350000	0.3353333	0.3390000
sift_gbm	0.3096667	0.3103333	0.3033333	0.3066667	0.3040000

```
> cv.result[[2]]
```

	eta = 0.1	eta = 0.2	eta = 0.3	eta = 0.4	eta = 0.5
hog_xgboost	0.3693333	0.3573333	0.3650000	0.3736667	0.3796667
lbp_xgboost	0.2513333	0.2566667	0.2633333	0.2590000	0.2690000
sift_xgboost	0.2490000	0.2536667	0.2576667	0.2693333	0.2643333

```
> cv.result[[4]]
```

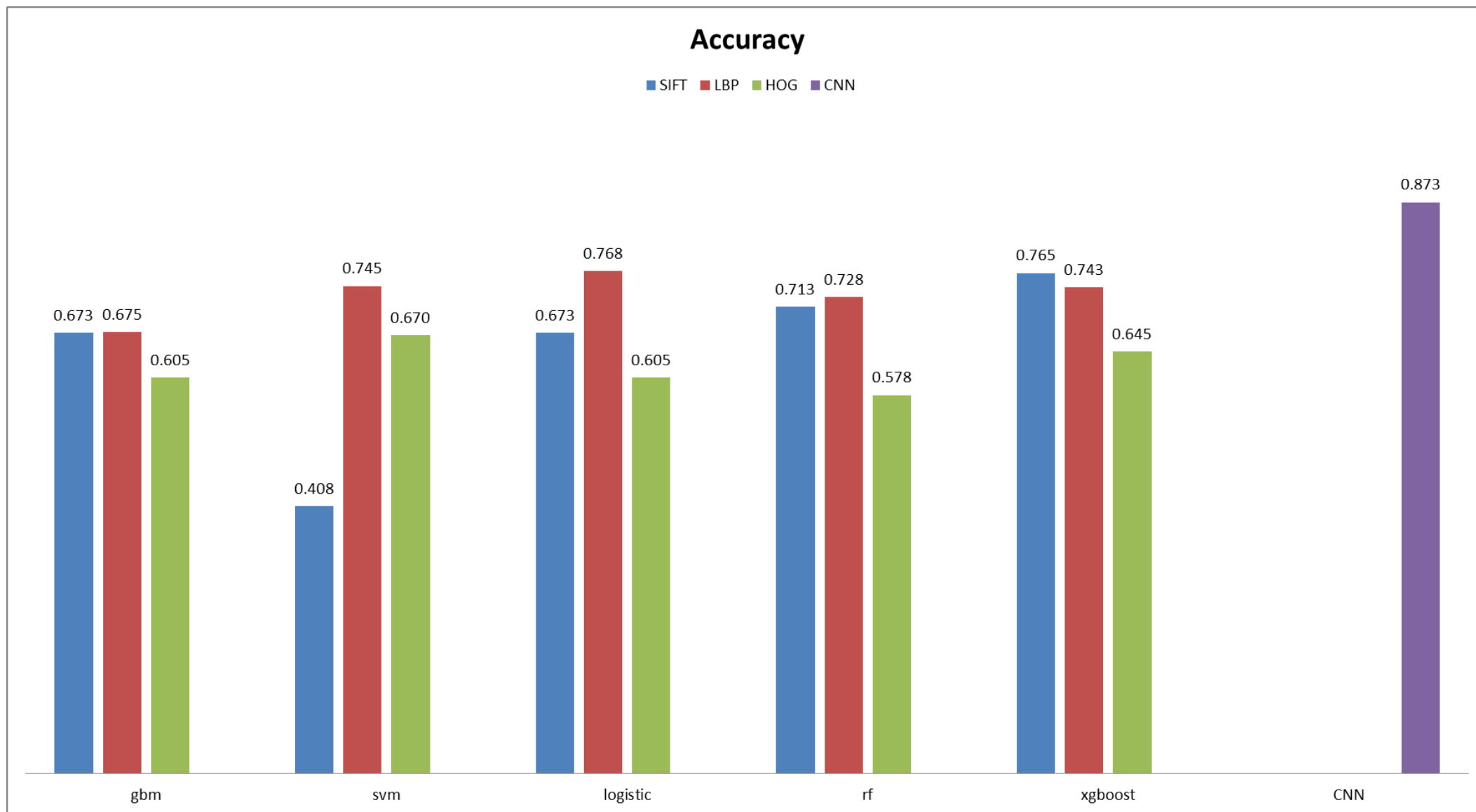
	ntree = 1000	ntree = 1500	ntree = 2000	ntree = 2500
mtry = 5	0.3720000	0.3773333	0.3663333	0.3646667
mtry = 6	0.3750000	0.3760000	0.3586667	0.3693333
mtry = 7	0.3630000	0.3766667	0.3810000	0.3690000
mtry = 8	0.3716667	0.3823333	0.3636667	0.3630000
mtry = 9	0.3703333	0.3830000	0.3703333	0.3776667
mtry = 10	0.3713333	0.3750000	0.3860000	0.3670000
mtry = 11	0.3720000	0.3833333	0.3786667	0.3716667
mtry = 12	0.3750000	0.3810000	0.3906667	0.3670000
mtry = 13	0.3730000	0.3780000	0.3806667	0.3783333
mtry = 14	0.3730000	0.3816667	0.3780000	0.3993333
mtry = 15	0.3743333	0.3866667	0.3786667	0.3643333

Tune parameter

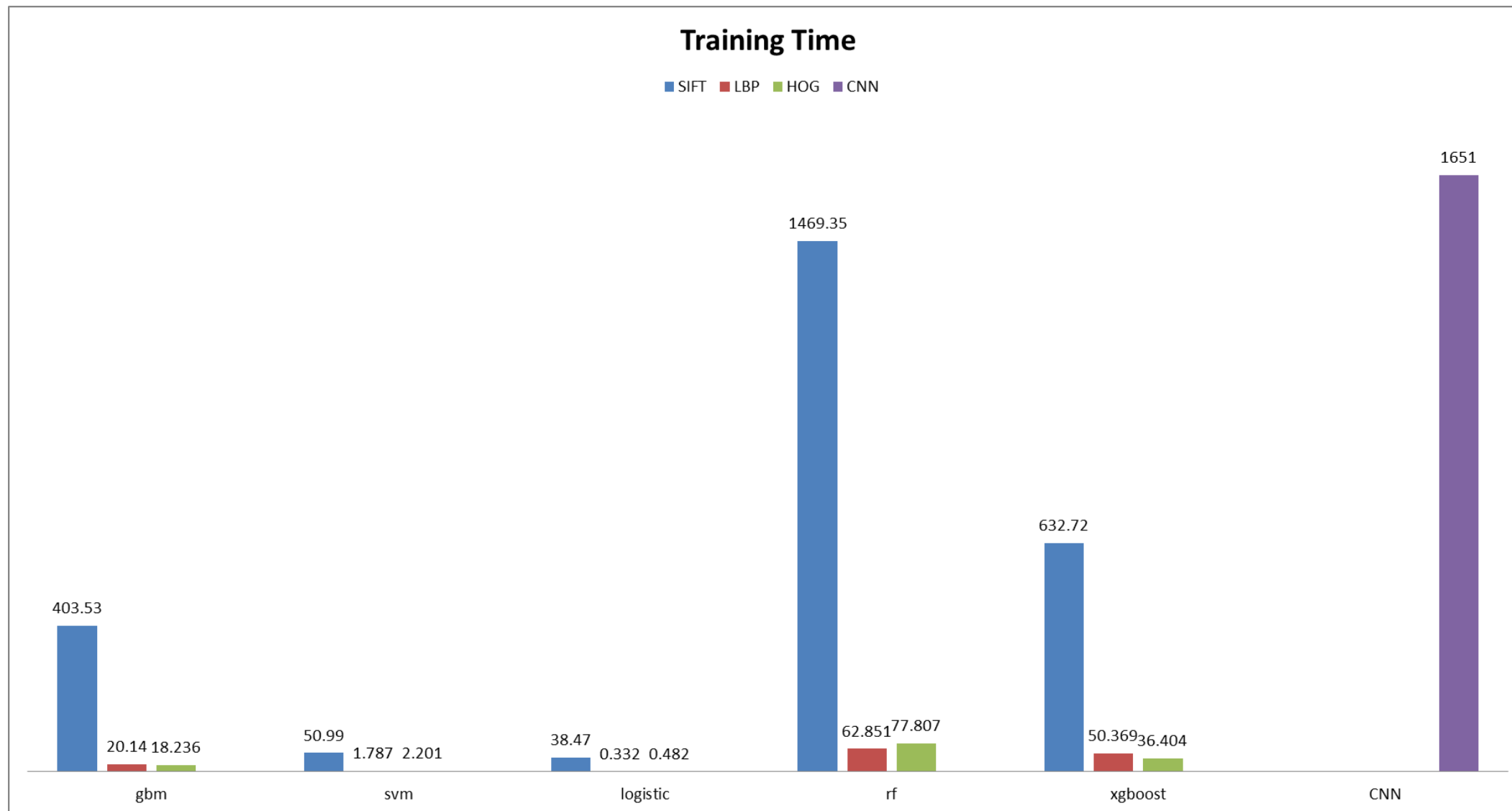
Visualize cross-validation results



## Model selection



## Model selection



# 4

A cluster of five small triangles: a large light red one pointing down-left, a medium red one pointing up-right, and three smaller dark grey ones pointing in various directions.

PART

Outcome

Four diagonal lines of varying lengths and colors (black and red) arranged around the word 'Outcome'.

# [ Our Best Model

## Local Binary Patterns + Logistic Regression

	Accuracy	Training Time
Baseline(SIFT+GBM)	67.3%	403.53s
Improved(LBP+Logistic)	76.8%	0.33s

