Aprendizaje Computacional
Curso 24-25

Digit Recognition

Participantes:

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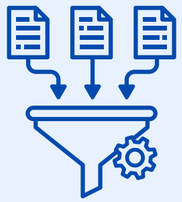
Resumen del proyecto

El conjunto de datos MNIST es un recurso clásico para la clasificación de imágenes de dígitos escritos a mano, utilizado en la investigación y enseñanza de la visión artificial. En esta proyecto, el objetivo es clasificar correctamente las imágenes de dígitos. Mientras debemos experimentar con diferentes algoritmos para entender su rendimiento y compararlos.

Objetivos



Procesamiento de datos del problema

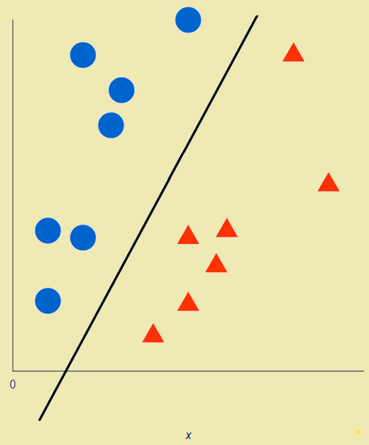
Resolver el problema con distintos modelos de machine learning

Determinar el mejor modelo con mayor accuracy y menor consumo de recursos

Modelos

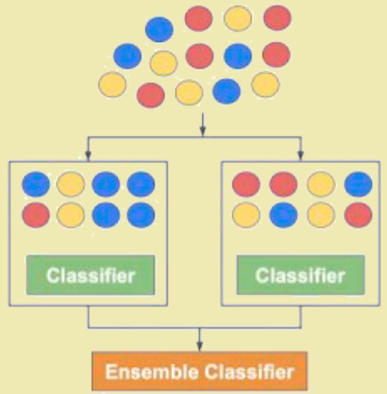
SVM

Alberto



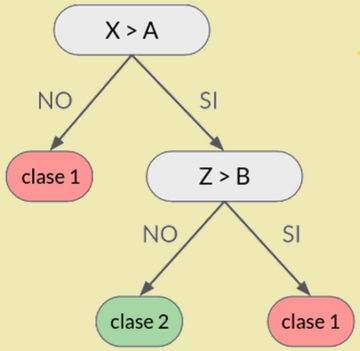
Bagging

María



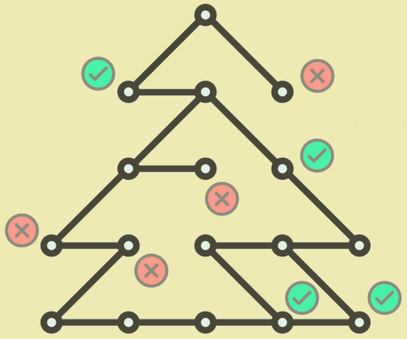
Rpart

Emilio



Random Forest

Javier



Procesamiento de datos

Carga

```
train <- read.csv("train.csv")
test <- read.csv("test.csv")
```

Inspección

```
prop.table(table(train$label)) * 100
train$label <- factor(train$label)
```

División

```
d_ size <- nrow ( train )
dtest _ size <- ceiling (0.2 * d_ size )
samples <- sample (1: d_size , d_size ,
replace = FALSE )
indexes <- samples [1: dtest _ size ]
dtrain <- train [ - indexes ,]
dtest <- train [ indexes ,]
```

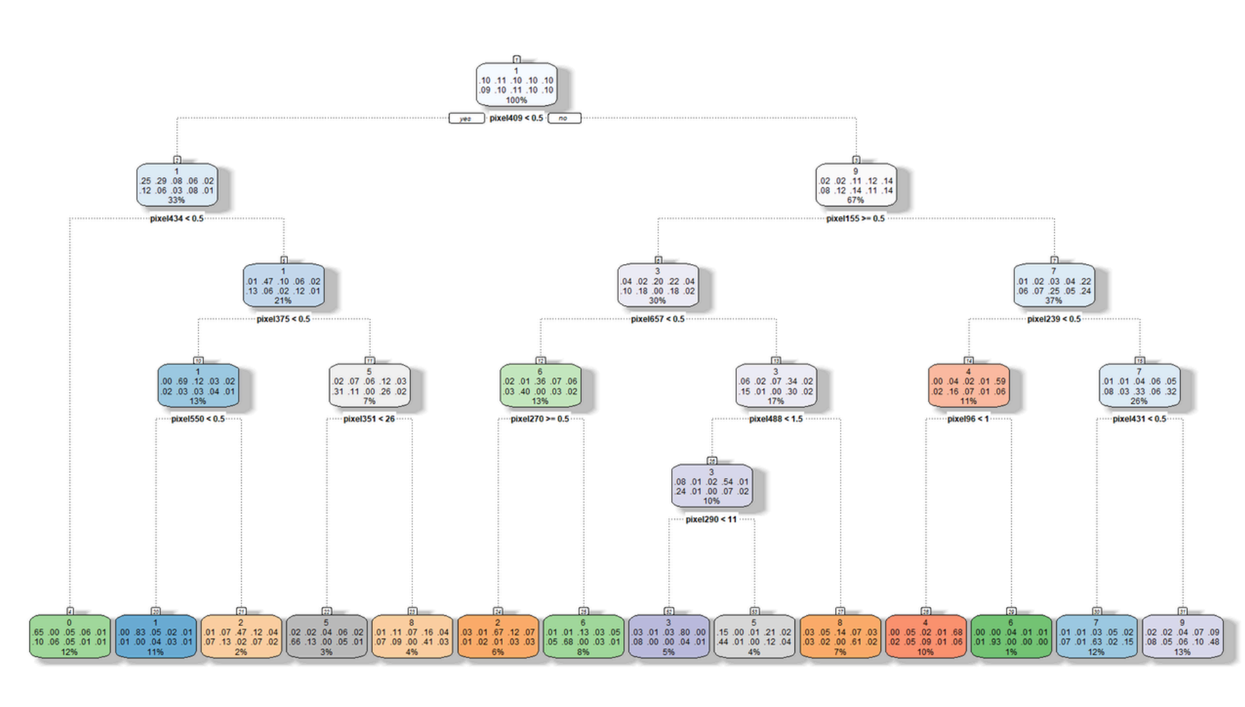
Train	Test
80%	20%

Rpart

```
start _ time <- Sys . time ()
tree = rpart ( label ~. , data = dtrain , method = " class ")
end _ time <- Sys . time ()
```

```
matrizconfusiontree <- table ( predict ( tree , newdata = dtest , type = " class ") ,
dtest $ label )
accuracytree <- sum ( diag ( matrizconfusiontree ) ) / sum ( matrizconfusiontree )
accuracytree
fancyRpartPlot ( tree )
barplot ( tree $ variable . importance )
```

Rpart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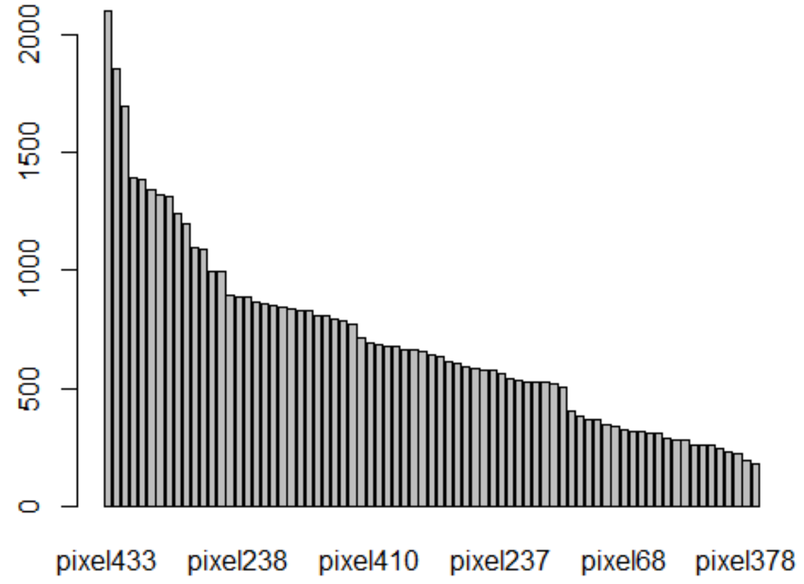
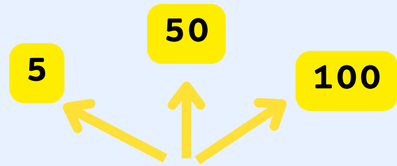
yes
no
pixel434 < 0.5
pixel155 >= 0.5
pixel375 < 0.5
pixel657 < 0.5
pixel239 < 0.5
pixel550 < 0.5
pixel351 < 26
pixel270 >= 0.5
pixel488 < 1.5
pixel96 < 1
pixel431 < 0.5
pixel290 < 11


0
500
1000
1500
2000
pixel433
pixel238
pixel410
pixel237
pixel68
pixel378

Random Forest

```
start _ time <- Sys . time ()
rf. model <- randomForest ( label ~ . , data = dtrain , ntree = 5)
end _ time <- Sys . time ()
save (rf.model , file ="rf5 .rda ")
end _ time - start _ time
```



```
rf. predict <- predict (rf.model , dtest )
matrizconfusionRF <- table (rf. predict , dtest $ label )
accuracyRF <- sum( diag ( matrizconfusionRF ) ) / sum( matrizconfusionRF )
accuracyRF
```

SVM

```
start _ time <- Sys . time ()
filter <- ksvm ( label ~ . , data = dtrain , kernel = " polydot ", kpar = list
( degree = 3) , cross = 3)
end _ time <- Sys . time ()
```

```
matrizconfusionKSVMpol <- table ( predict ( filter , dtest ) , dtest $ label )
accuracyksvmpol <- sum(diag (matrizconfusionKSVMpol)) / sum(matrizconfusionKSVMpol)
# Mostrar resultados
print ( matrizconfusionKSVMpol )
cat (" Accuracy del modelo :", accuracyksvmpol , "\n")
cat (" Tiempo de ejecución SVM :", end_time - start _time , "\n")
```

Bagging

```
start _ time <- Sys . time ()
Modelo _ AdaBag <- bagging ( label ~. , data = dtrain , na. action = na.omit ,
mfinal =9 , control = rpart . control ( cp = 0.001 , minsplit =7) )
end _ time <- Sys . time ()
```

```
matrizconfusionBag <- table ( dtest [ , " label "] , predict ( Modelo _AdaBag,
                    newdata = dtest , type = " class ")$ class )
accuracyBag <- sum( diag ( matrizconfusionBag ) ) / sum( matrizconfusionBag )
print ( matrizconfusionBag )
cat (" Accuracy del modelo :", accuracyBag , "\n")
cat (" Tiempo de ejecución Bagging :", end_time - start _time , "\n")
```

Resultados obtenidos de los modelos

Rpart

Accuracy: 0.6333
Time: 53.2402 seg

Random Forest

5 Árboles
Accuracy: 0.9104
Time: 24.9980 seg

50 Árboles
Accuracy: 0.9632
Time: 4.4706 min

100 Árboles
Accuracy: 0.9663
Time: 16.855 min

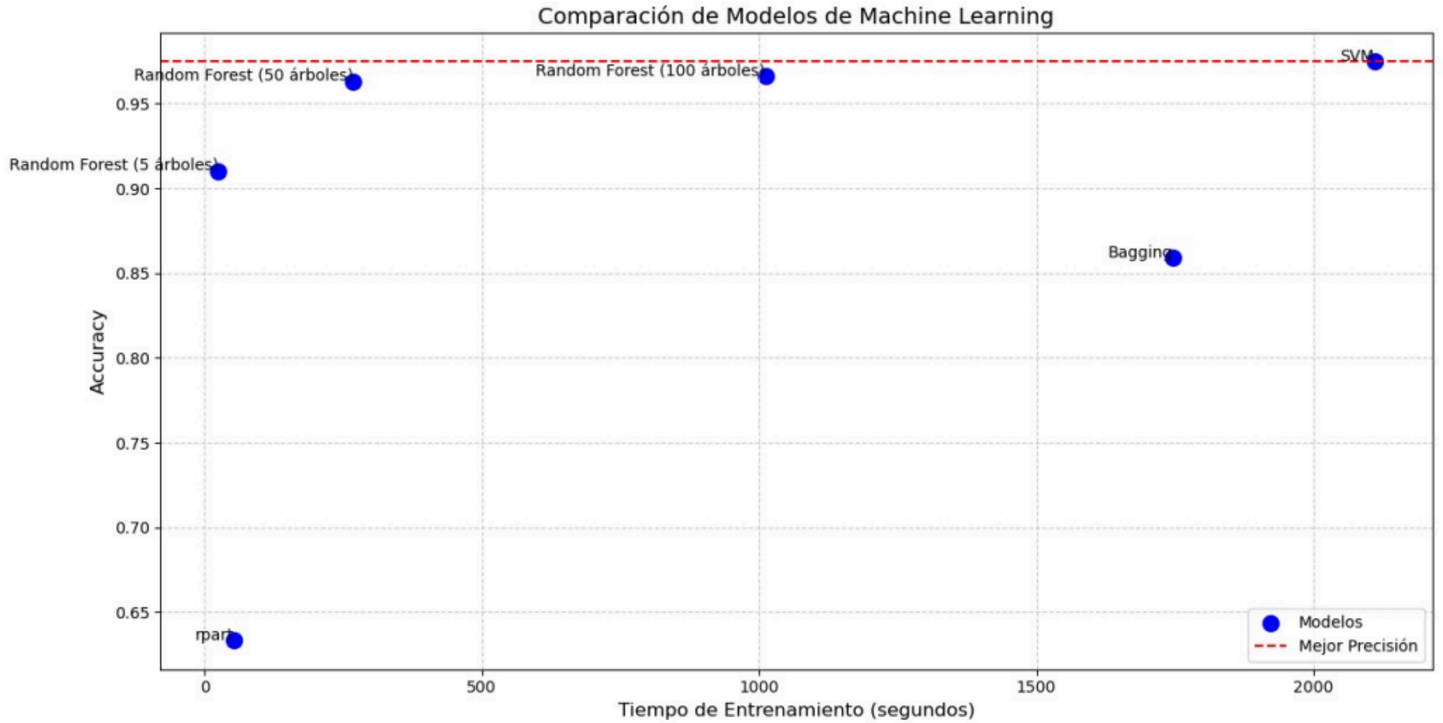
SVM

Accuracy: 0.9748
Time: 35.1554 min

Bagging

Accuracy: 0.8594
Time: 29.1157 min

Conclusión



Depende de los requerimientos del problema

Maximizar precisión sin tener en cuenta el tiempo

SVM

Compromiso entre precisión y eficiencia computacional

Random Forest

50 Árboles

Maximizar eficiencia computacional con menor eficiencia

Rpart