# Prediction and analysis of state exams via the use of decision trees

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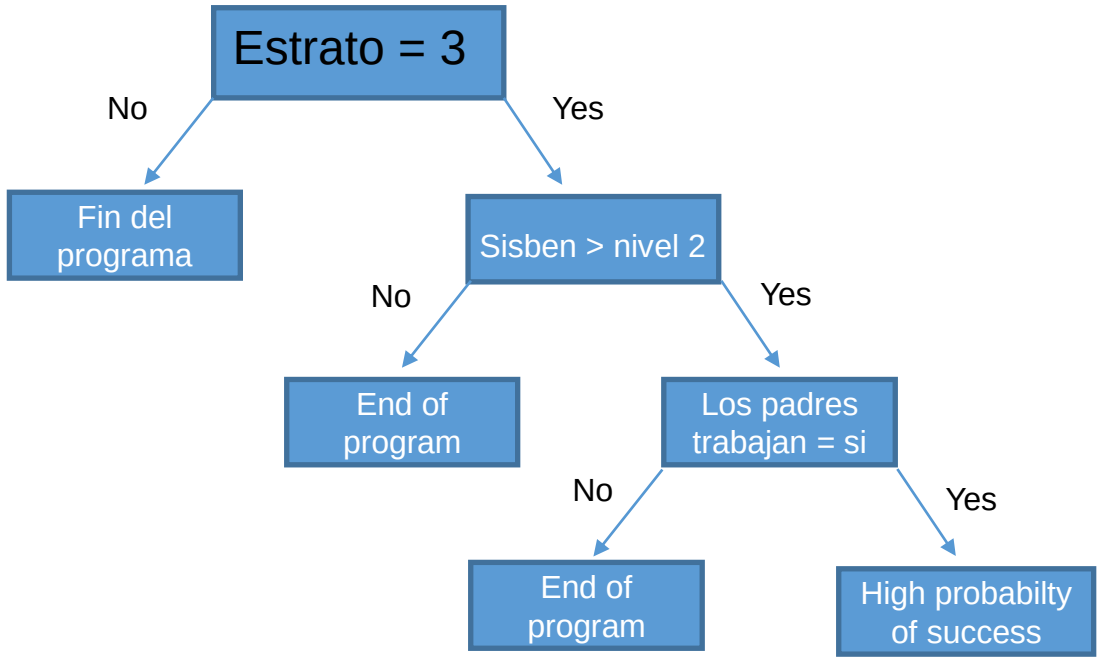
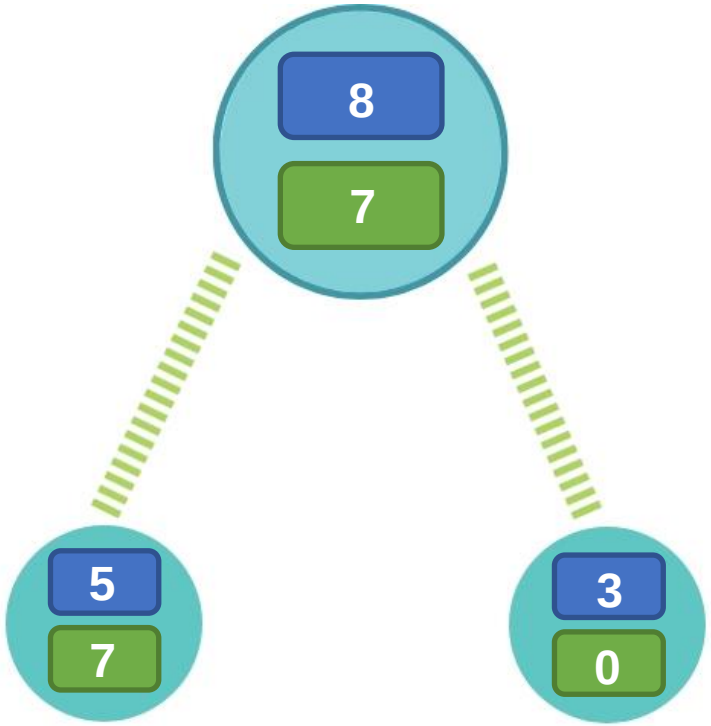
http://github.com/ Jpyepes **/proyecto/**

# Algorithm Design

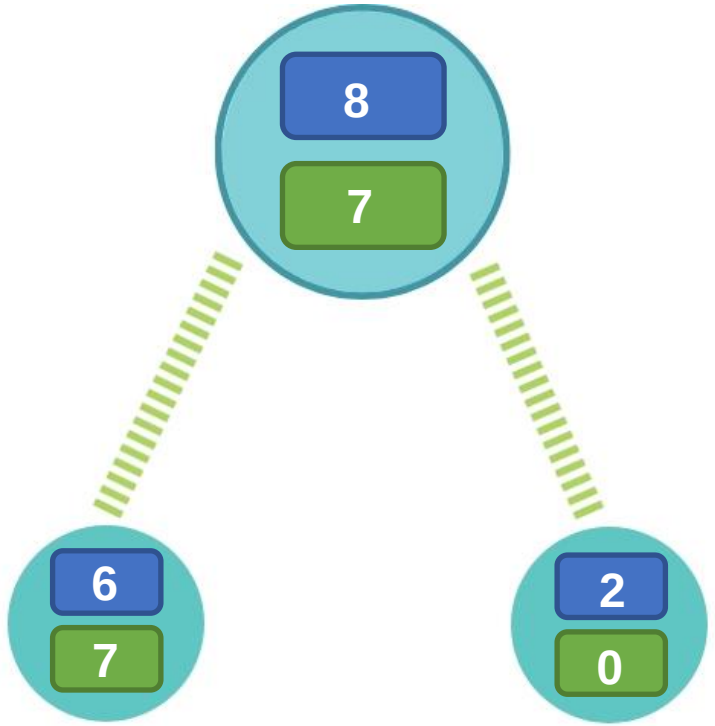



This model represents a hypothetical situation in which 3 conditions approximate the probability of success of the student.

# Node Splitting




This node split is based on the condition “fami_nivelsisben == Nivel 2.”
For this case, left Gini impurity is 0.474, right Gini impurity is 0.0, and weighted Gini impurity is 0.385.
Elements in blue boxes were marked as having success “0”, and elements in green boxes with success “1”.

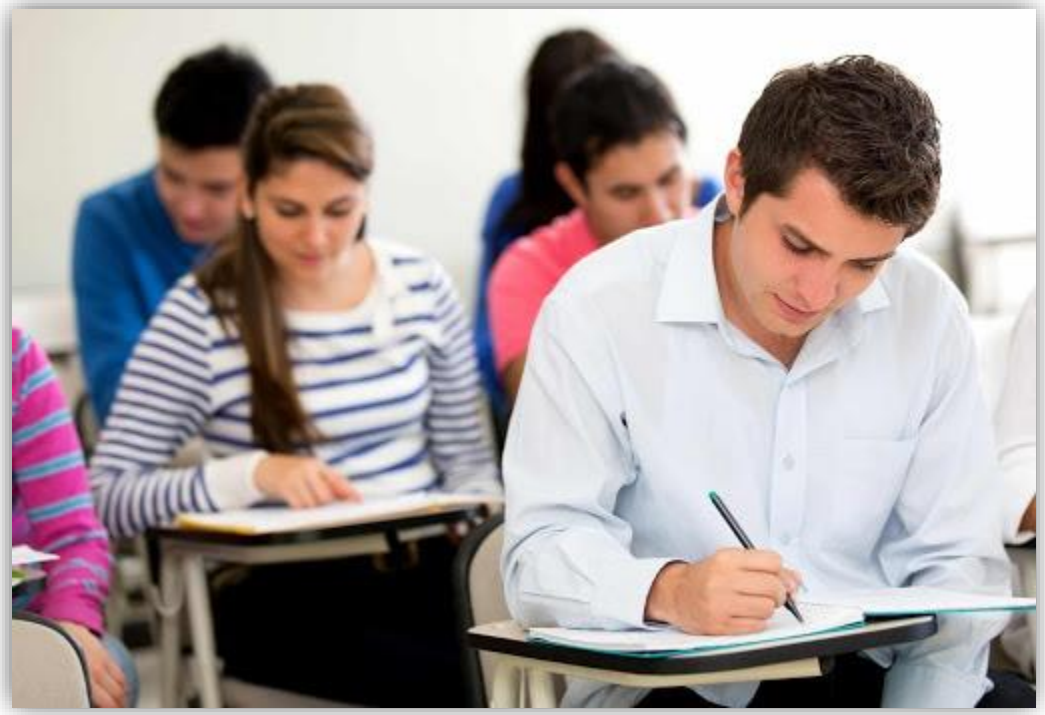



This node split is based on the condition “fami_estratovivienda.1 == Estrato 1”
For this case, left Gini impurity is 0.90, right Gini impurity is 0, and weighted Gini impurity is 0.429.
Elements in blue boxes were marked as having success “0”, and elements in green boxes with success “1”.

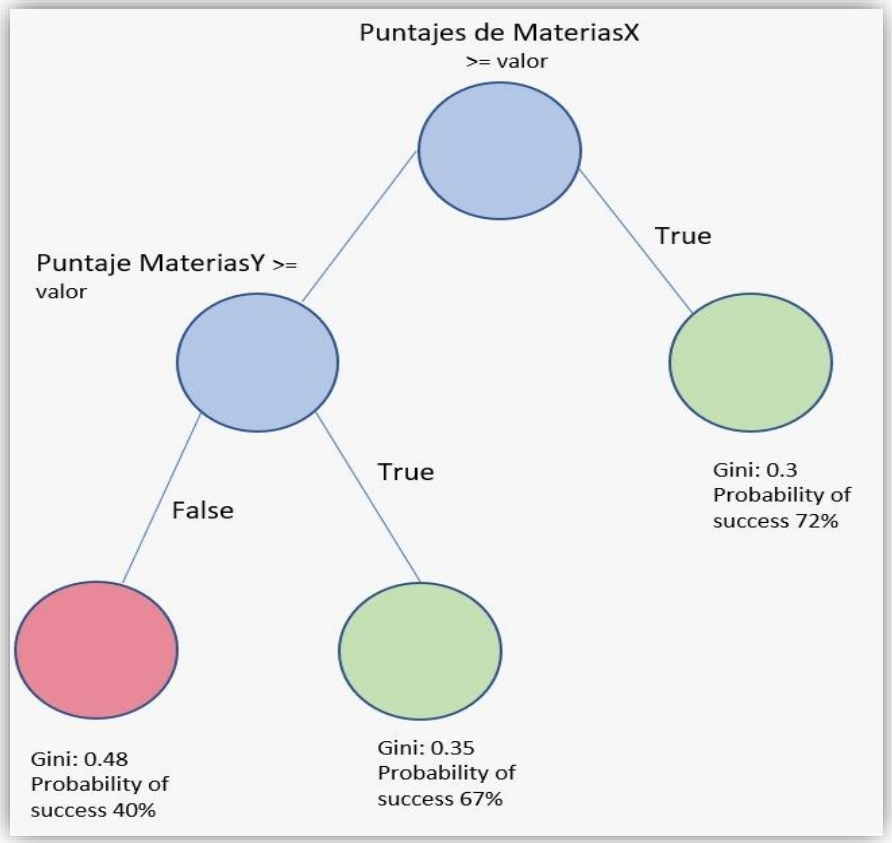
# Complexity of the algorithm

| | Time complexity | Space complexity |
|---|---|---|
| Training | O(m*n*2^m) | O(m*n ) |
| Testing | O(m*n*log n) | O(m*n ) |

Where n is the number of rows and m is the number of columns of the two dimensional array that stores the data sets.



# Decision Tree Model




Graph of a tree with possible values

## Deciding factors in prediction

*Results of the different academic modules the ICFES tests*

The tree only analyses the columns that contain the results of the academic modules (Language, mathematics, etc.). This decision was taken because we consider this is the most objective approach and the one that presents less errors in its implementation.

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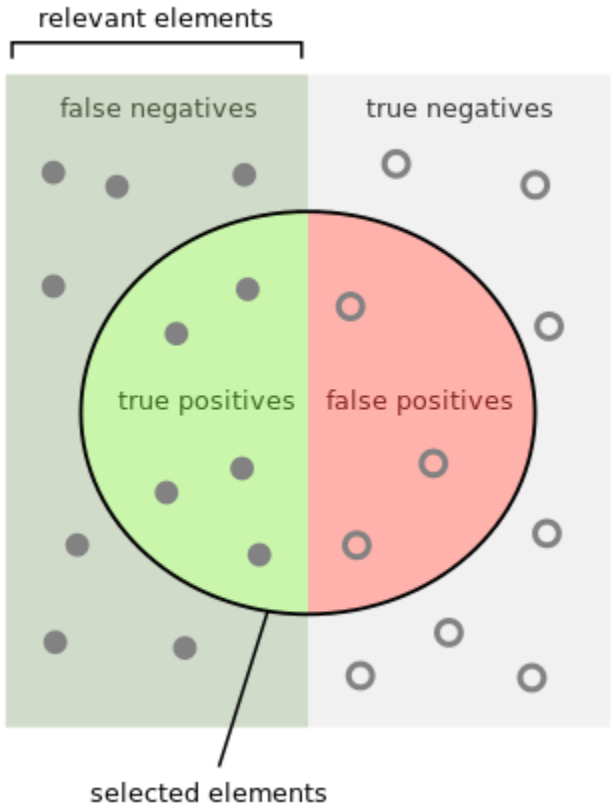
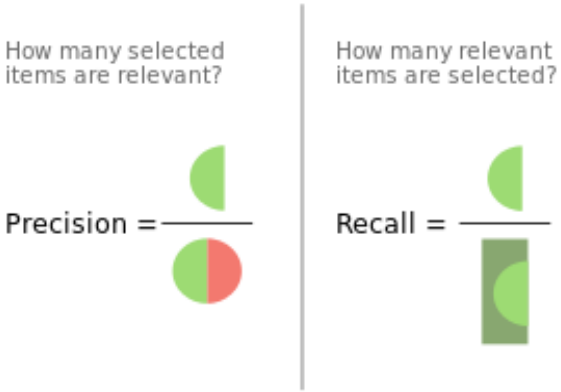
# Evaluation Metrics




Accuracy: is the number of students who got it right (both good and bad) divided by the total number of students.

Precision: is the number of predictions that were successful divided by the number of predictions that were successful plus the false positives

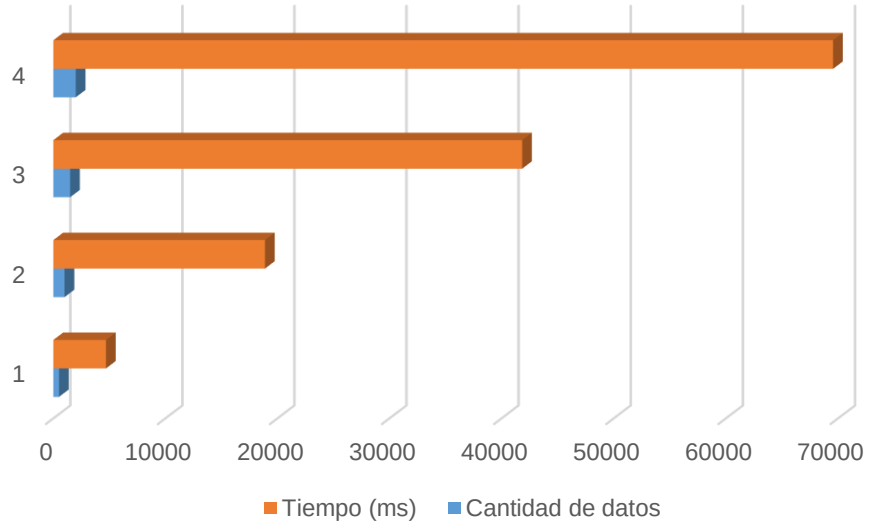
Recall: is the number of predictions that were successful divided by the number of predictions that were successful plus the false negatives

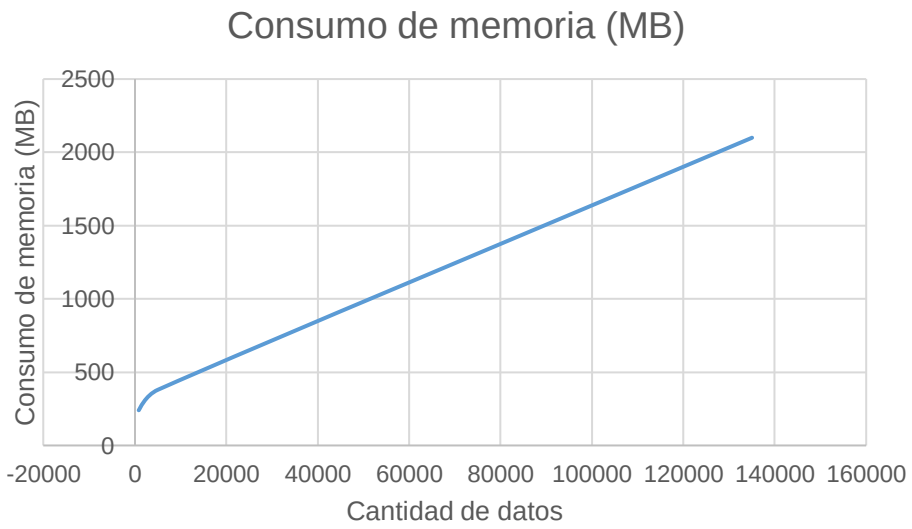
# Evaluation Metrics

| | Training Data | Testing Data |
|---|---|---|
| **Accuracy** | 75% | 69% |
| **Precision** | 50.1% | 83.55% |
| **Recall** | 52.5% | 52.5% |

Evaluation metrics using a training dataset of 135,000 students and test dataset of 45,000 students.

# Time and Memory Consumption




Time Consumption

Memory Consumption

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# Documentation

PACKAGE CLASS TREE INDEX HELP

ALL CLASSES

SUMMARY: NESTED | FIELD | CONSTR | METHOD DETAIL: FIELD | CONSTR | METHOD

SEARCH: Search

## Class ElArbolito

java.lang.Object
    ElArbolito

```
public class ElArbolito
extends Object
```

Esta clase esta basada en el video "Let's Write a Decision Tree Classifier from Scratch": https://www.youtube.com/watch?v=LDRbO9a6XPU

### *Constructor Summary*

**Constructors**

| Constructor | Description |
|---|---|
| `ElArbolito(String[][] raiz)` | ElArbolito es un constructor de la clase que recibe una matriz y utiliza las diferente clases de este proyecto para generar el Arbol |

### *Method Summary*

**All Methods** | **Instance Methods** | **Concrete Methods**

| Modifier and Type | Method | Description |
|---|---|---|
| `Nodo` | `CrearArbol(String[][] matriz)` | El metodo crearArbol utiliza un llamado recursivo con las dos ramas para asi crear el arbol, sin emabrgo, antes de este llamado hay diferentes condiciones para asegurarse de que no haya error alguno |
| `Nodo` | `getRaiz()` | |
| `int` | `predecir(String[] estudiante, Nodo nodo)` | El metodo predecir por medio de la recursion intenta hacer la prediccion de un estudiante con base en los puntajes logrados |
| `boolean` | `tieneHoja(Nodo nodo)` | |

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THANKS AGAIN!