

# EMPLOYEE ATTRITION PREDICTION

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# 1. INTRODUCTION

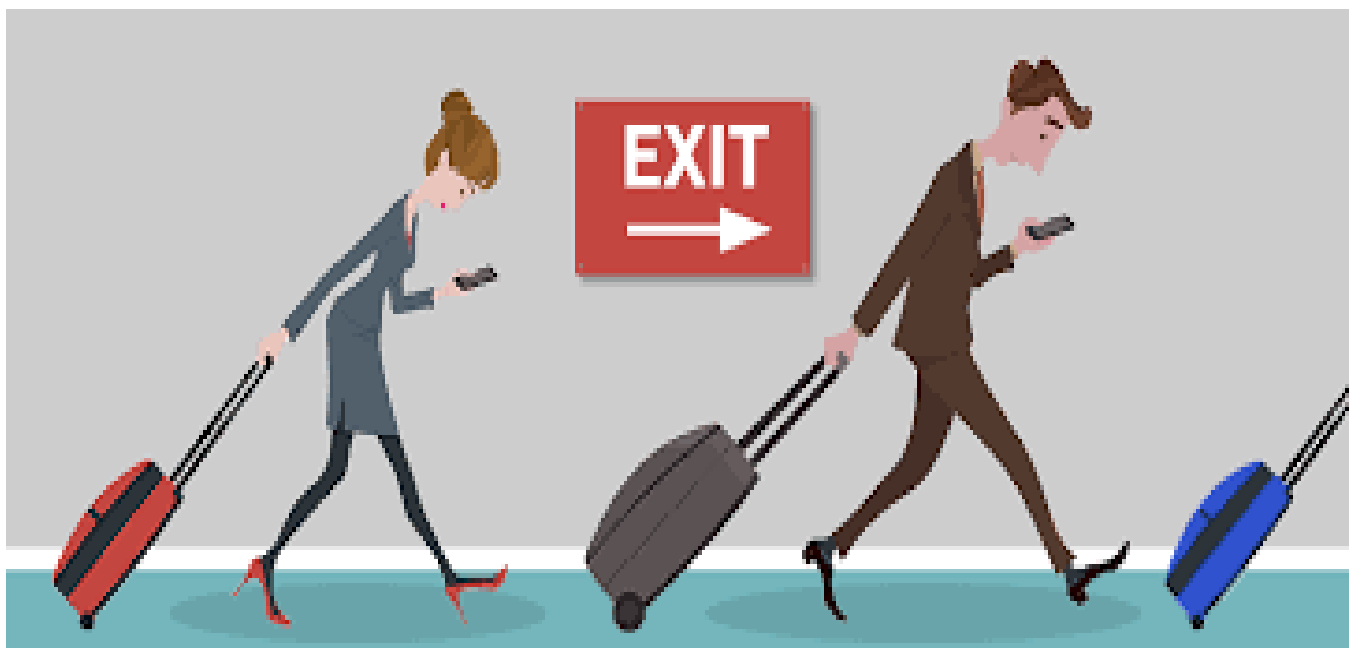
## What is Machine Learning?

**Machine learning** is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. **Machine learning** focuses on the development of computer programs that can access data and use it learn for themselves. There are three sorts of machine Learning- Supervised Learning, Unsupervised Learning and Reinforcement Learning.

## What is Attrition?

"Employee attrition is defined as the natural process by which employees leave the workforce – for example, through resignation for personal reasons or retirement – and are not immediately replaced."

*Some forms of attrition are unavoidable, like if an employee is retiring or is moving to another city. But after a certain threshold, attrition can make a big dent in your company's bottom line as well as its culture. In this primer, we tell you all you need to know about employee attrition, and how to measure it accurately.*



## 1.1 OVERVIEW:

**Attrition Rate = Number of Attritions/Average Number of Employees x 100**

## What Are the Different Types of Attrition?

There are five types of employee attrition that you need to know of:

### 1. Attrition due to retirement

If two or three people have retired from your company this year, this is statistically too small an employee group to count under attrition. However, if a sizable chunk of your workforce retires at the same time, this can cause attrition.

### 2. Voluntary attrition

This is the most common type of attrition, where employees decide to simply quit their jobs. There can be many reasons for voluntary attrition and most of them are in your control.

You should proactively try to curb voluntary attrition among high-value talent, as this can bring down your productivity over time. For example, if a company sees its marketing experts moving out of different business units, it's a clear cause for concern.

### 3. Involuntary attrition

In this scenario, it is the company and not the employee that initiates the exit. For example, the employee may have shown instances of misconduct in the workplace – a common reason for involuntary attrition. Structural reasons could also cause attrition. Mergers and acquisitions are often followed by a wave of involuntary attrition.

### 4. Internal attrition

Here, employees are quitting their jobs in one department to join another department. In some cases, internal attrition is desirable, as it routes talent towards more profitable areas. It also ensures better employee-job fitment.

But if a specific department has witnessed a high rate of attrition one year, it merits an investigation. Is there something missing in the job? Is the manager inadequately skilled?



#### 5. Demographic-specific attrition

This is a significant concern for progressive companies trying to build an equal-opportunities workplace. Demographic-specific attrition means that employees from a single group – women, ethnic minorities, people with disabilities, veterans, or older professionals – are leaving the company in droves.

## Employee attrition vs. turnover

When defining attrition, remember not to confuse it with turnover. Vacancies left by attrition aren't immediately filled up. This is because a lot of factors can contribute to attrition, including retirement, planned resignations, and structural changes.

Turnover, in contrast, is a more short-term metric. The dent made by turnover must be addressed immediately through rehiring.

## 1.2 PURPOSE:

The one factor that makes employee attrition so dangerous is that companies are not prepared. The loss stems from the fact that there is a big void in the company. Employees who leave not just leave physically but they also take with them years of experience. The loss in experience creates additional pressure on the team and finally to the whole organization. On top of that companies have to go for an intensive training session with their new employee which adds to expenses. Employee leaving the company adds additional pressure on the remaining employees in the company since there is no immediate replacement. The remaining employees are often required to do overtime and extra work without any added compensation. This, in turn, creates a cyclic process of the remaining employees considering offers from other companies due to workplace stress. The cost of professional development due to employee attrition is high. These stress and chaos of employee attrition stem down to even customer attrition.

An infographic with a teal background. In the center, there is a faint image of a woman's face with her hands resting on her cheeks, looking upwards. Overlaid on this image is the text '75%' in large white font. Below it, in smaller white font, is the text 'of the reasons employees leave could have been prevented by the employer.' In the bottom right corner, in a small white font, is the text 'Source: Work Institute'.

**75%**

of the reasons employees leave  
could have been prevented  
by the employer.

Source: Work Institute

## **2 LITREATURE SERVICE :**

### **2.1EXISTING PROBLEM:**

Employee attrition occurs when the size of your workforce diminishes over time due to unavoidable factors such as employee resignation for personal or professional reasons.

Employees are leaving the workforce faster than they are hired, and it is often outside the employer's control. For example, let's say that you have opened a new office designated as the Sales Hub for your company. Every salesperson must work out of this office – but a few employees cannot relocate and choose to leave the company. This is a typical reason for employee attrition.

But there are other reasons for attrition as well, including the lack of professional growth, a hostile work environment, or declining confidence in the company's market value. Weak leadership is another factor that often drives attrition among employees.

### **2.2PROPOSED SOLUTION:**

To help solve employee attrition in organizations, we aim at predicting whether an employee will leave the company or not through a machine learning model. We will be able to correlate the factors for leaving the company and help companies improve. This project can help the organizations have a more experienced workforce as the organizations will retain their useful employees. It will also help the employees have a stable work life too as the employers will understand the needs of their employees.



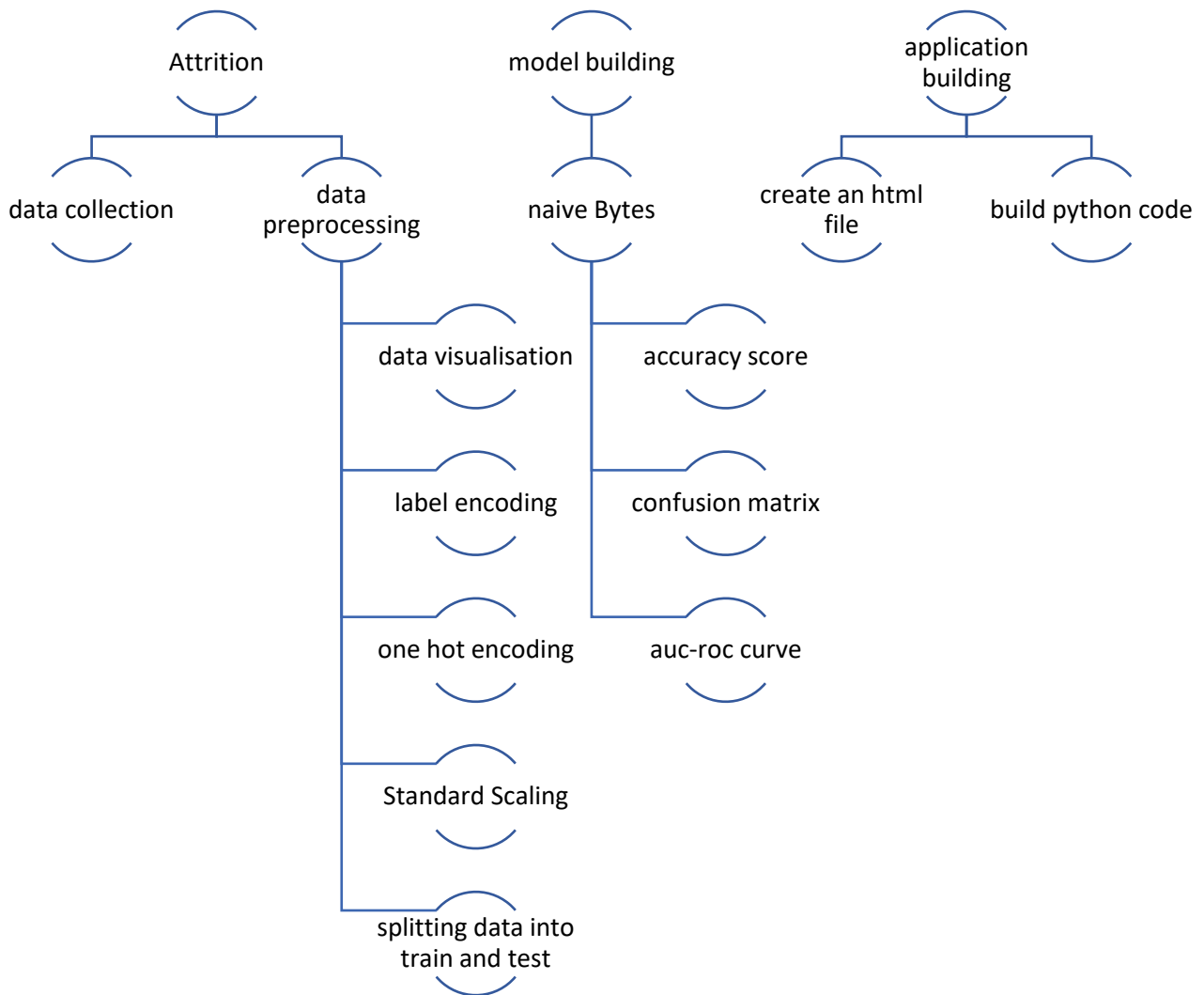
# **3.THEORETICAL ANALYSIS**

## **3.1BLOCK DIAGRAM**

- 1) Data collection
- 2) Data Pre-processing
- 3) Model Building
- 4) Application Building

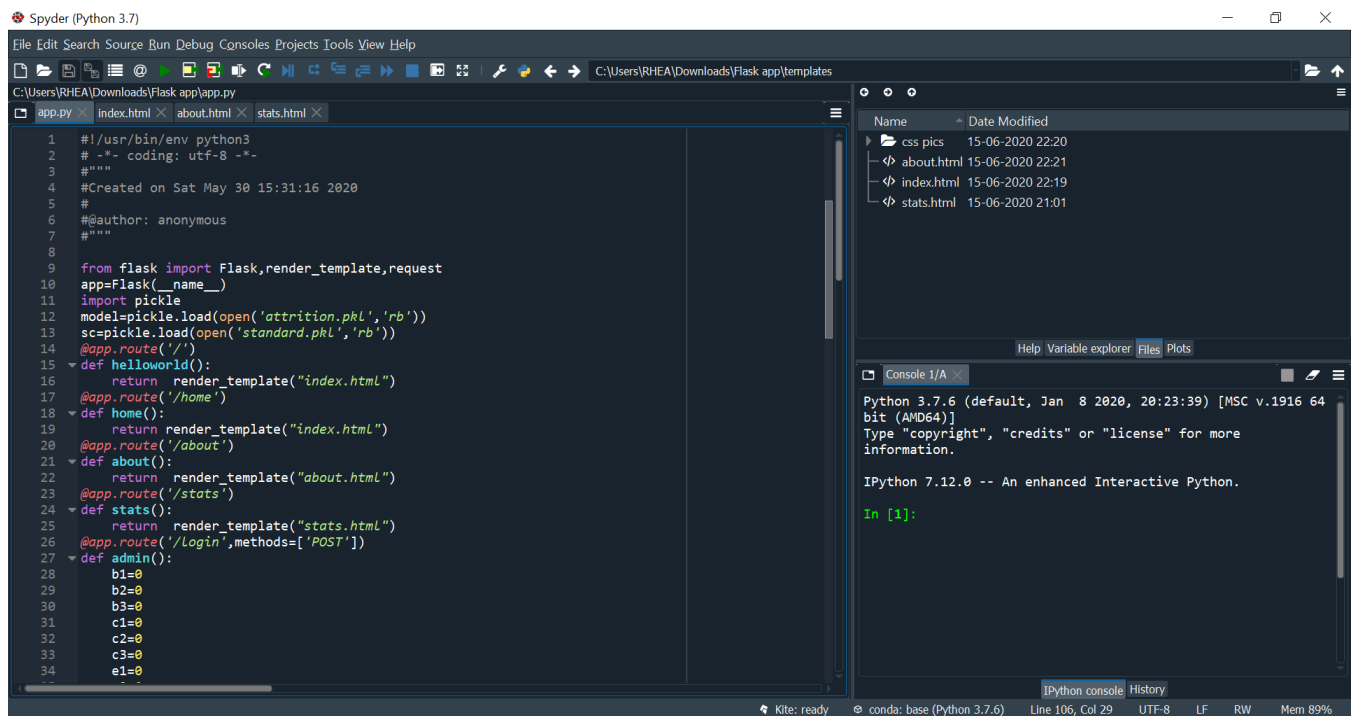
## **Hardware/Software designing**

Software: We used Jupyter Notebook and Spyder for our model building



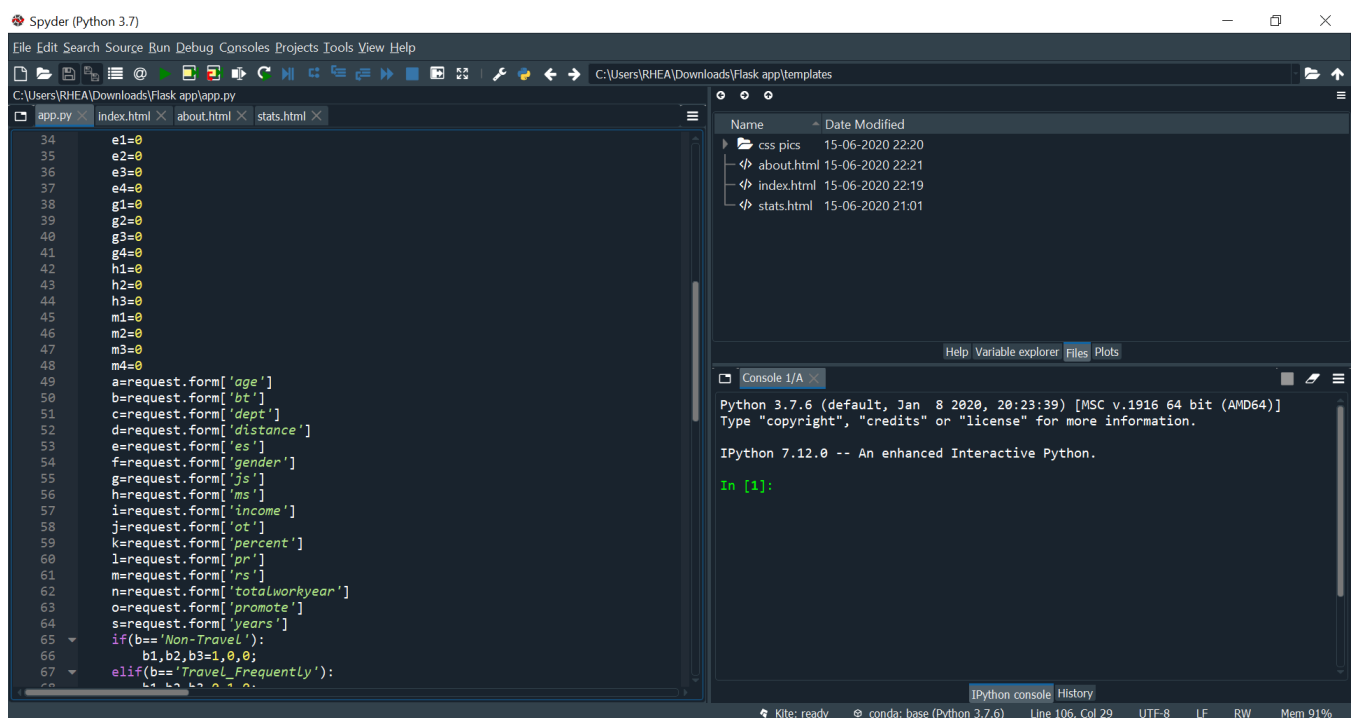
# 4. Experimental investigations

After trying various classifiers such as decision tree classifier, Random tree classifier, Logistic Regression, SVM, KNN and Naïve Bytes, I found that Naïve Bytes has the most auc value in the roc\_auc curve. This lead me to use the Naïve Bytes for my python program as accuracy of a model majorly depends on its auc value.



The screenshot shows the Spyder Python IDE with a Flask application code file open. The code defines a Flask app with routes for helloworld, home, about, stats, and admin. The admin route is a POST endpoint. The file explorer on the right shows the project structure with css, pics, about.html, index.html, and stats.html files. The console at the bottom shows the Python 3.7.6 environment and the IPython 7.12.0 prompt.

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  #Created on Sat May 30 15:31:16 2020
5  #
6  #@author: anonymous
7  #"""
8
9  from flask import Flask,render_template,request
10 app=Flask(__name__)
11 import pickle
12 model=pickle.load(open('attrition.pkl','rb'))
13 sc=pickle.load(open('standard.pkl','rb'))
14 @app.route('/')
15 def helloworld():
16     return render_template("index.html")
17 @app.route('/home')
18 def home():
19     return render_template("index.html")
20 @app.route('/about')
21 def about():
22     return render_template("about.html")
23 @app.route('/stats')
24 def stats():
25     return render_template("stats.html")
26 @app.route('/Login',methods=['POST'])
27 def admin():
28     b1=0
29     b2=0
30     b3=0
31     c1=0
32     c2=0
33     c3=0
34     e1=0
```



The screenshot shows the continuation of the Flask application code in the Spyder Python IDE. The code continues from the previous snippet, defining variables b1 through b4, and then processing request parameters a through s. It includes conditional logic for 'Non-Travel' and 'Travel\_Frequently' categories. The file explorer and console remain the same as in the previous screenshot.

```
34     e1=0
35     e2=0
36     e3=0
37     e4=0
38     g1=0
39     g2=0
40     g3=0
41     g4=0
42     h1=0
43     h2=0
44     h3=0
45     m1=0
46     m2=0
47     m3=0
48     m4=0
49 a=request.form['age']
50 b=request.form['bt']
51 c=request.form['dept']
52 d=request.form['distance']
53 e=request.form['es']
54 f=request.form['gender']
55 g=request.form['js']
56 h=request.form['ms']
57 i=request.form['income']
58 j=request.form['ot']
59 k=request.form['percent']
60 l=request.form['pr']
61 m=request.form['rs']
62 n=request.form['totalworkyear']
63 o=request.form['promote']
64 s=request.form['years']
65 if(b== 'Non-Travel'):
66     b1,b2,b3=1,0,0;
67 elif(b== 'Travel_Frequently'):
```

```
68     b1,b2,b3=0,1,0;
69     elif(b== 'Travel Rarely'):
70         b1,b2,b3=0,0,1;
71     if(c== 'Human Resources'):
72         c1,c2,c3=1,0,0;
73     elif(c== 'Research & Development'):
74         c1,c2,c3=0,1,0;
75     elif(c== 'Sales'):
76         c1,c2,c3=0,0,1;
77     if(e==1):
78         e1,e2,e3,e4=1,0,0,0;
79     elif(e==2):
80         e1,e2,e3,e4=0,1,0,0;
81     elif(e==3):
82         e1,e2,e3,e4=0,0,1,0;
83     elif(e==4):
84         e1,e2,e3,e4=0,0,0,1;
85     if(g==1):
86         g1,g2,g3,g4=1,0,0,0;
87     elif(g==2):
88         g1,g2,g3,g4=0,1,0,0;
89     elif(g==3):
90         g1,g2,g3,g4=0,0,1,0;
91     elif(g==4):
92         g1,g2,g3,g4=0,0,0,1;
93     if(h== 'Divorced'):
94         h1,h2,h3=1,0,0;
95     elif(h== 'Married'):
96         h1,h2,h3=0,1,0;
97     elif(h== 'Single'):
98         h1,h2,h3=0,0,1;
99     if(m==1):
100         m1,m2,m3,m4=1,0,0,0;
101     elif(m==2):
```

```
95     elif(h== 'Married'):
96         h1,h2,h3=0,1,0;
97     elif(h== 'Single'):
98         h1,h2,h3=0,0,1;
99     if(m==1):
100         m1,m2,m3,m4=1,0,0,0;
101     elif(m==2):
102         m1,m2,m3,m4=0,1,0,0;
103     elif(m==3):
104         m1,m2,m3,m4=0,0,1,0;
105     elif(m==4):
106         m1,m2,m3,m4=0,0,0,1;
107     if(f== 'Female'):
108         f=0;
109     elif(f== 'Male'):
110         f=1;
111     if(j== 'No'):
112         j=0;
113     elif(j== 'Yes'):
114         j=1;
115     if(l== '3'):
116         l=0;
117     elif(l== '4'):
118         l=1;
119     t=[int(m1),int(m2),int(m3),int(m4),int(h1),int(h2),int(h3),int(g1),int(g2)
120     y=model.predict(sc.fit_transform(t))
121     y=str(y[0])
122     if(y=='0'):
123         z="The employee will stay."
124     else:
125         z="The employee will leave..."
126     return render_template("index.html",y=z)#as y is a dataframe lists of list
127 if __name__=="__main__":
128     app.run(debug=True)
```

App.py – flask app code

[illegible]

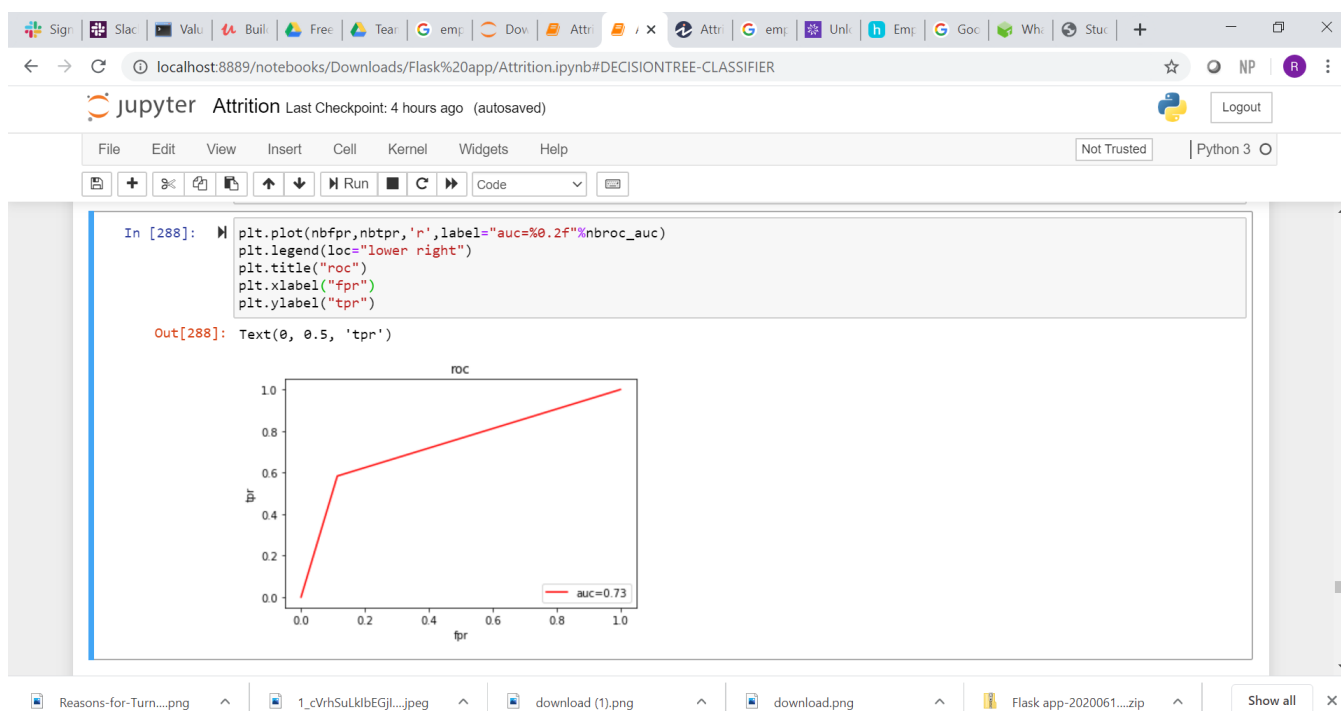
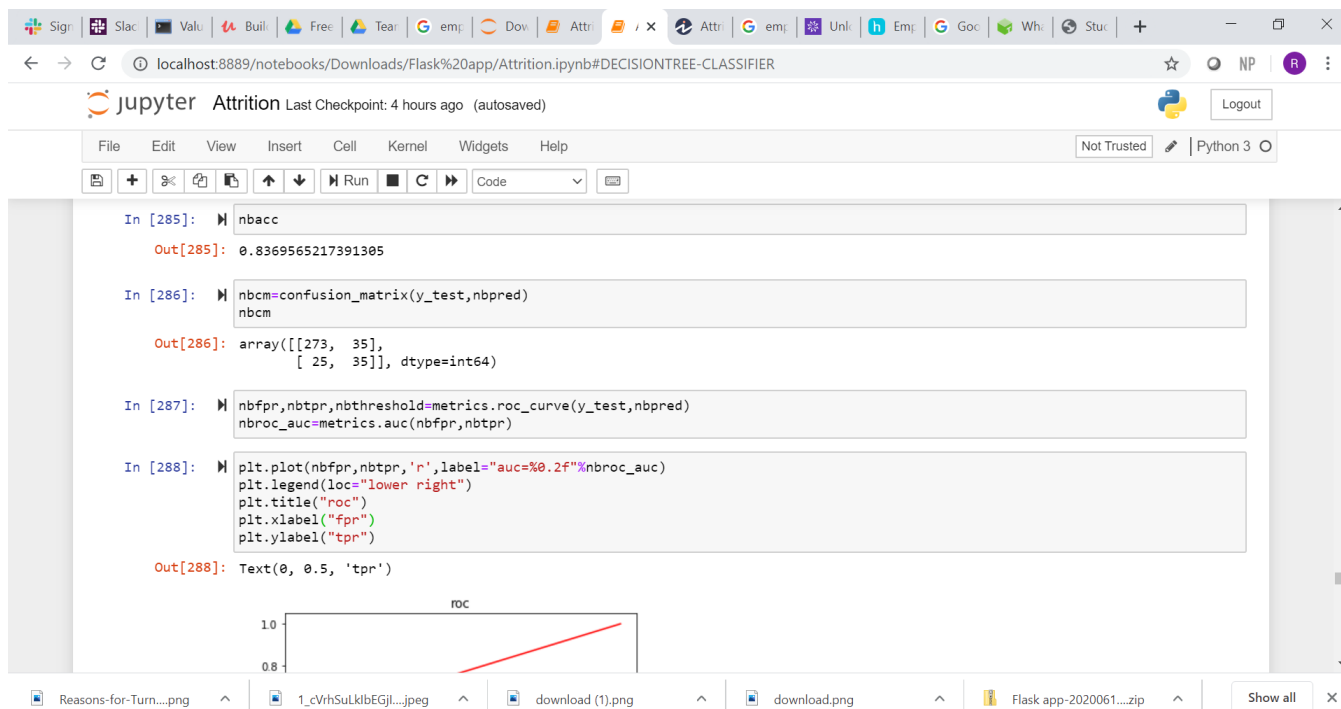
The screenshot shows a Jupyter Notebook interface. The top bar indicates the notebook is titled "Attrition" and is located at "localhost:8889/notebooks/Downloads/Flask%20app/Attrition.ipynb#DECISIONTREE-CLASSIFIER". The notebook is autosaved 4 hours ago. The interface includes a menu bar (File, Edit, View, Insert, Cell, Kernel, Widgets, Help) and a toolbar with icons for file operations, running cells, and code execution. The main area displays two code cells. The first cell, labeled "In [283]:", contains a list of test samples, each represented as a list of 14 numerical values. The second cell, labeled "In [284]:", contains code to calculate the accuracy of the model using the test samples and the predicted values from the previous cell.

```
In [283]: y_test
[[1],
 [0],
 [1],
 [0],
 [0],
 [0],
 [0],
 [1],
 [0],
 [0],
 [0],
 [0],
 [1],
 [1],
 [0],
 [0],
 [0],
 [0],
 [0],
 [0]]

In [284]: #accuracy
from sklearn.metrics import accuracy_score
nbacc=accuracy_score(y_test,nbpred)
```

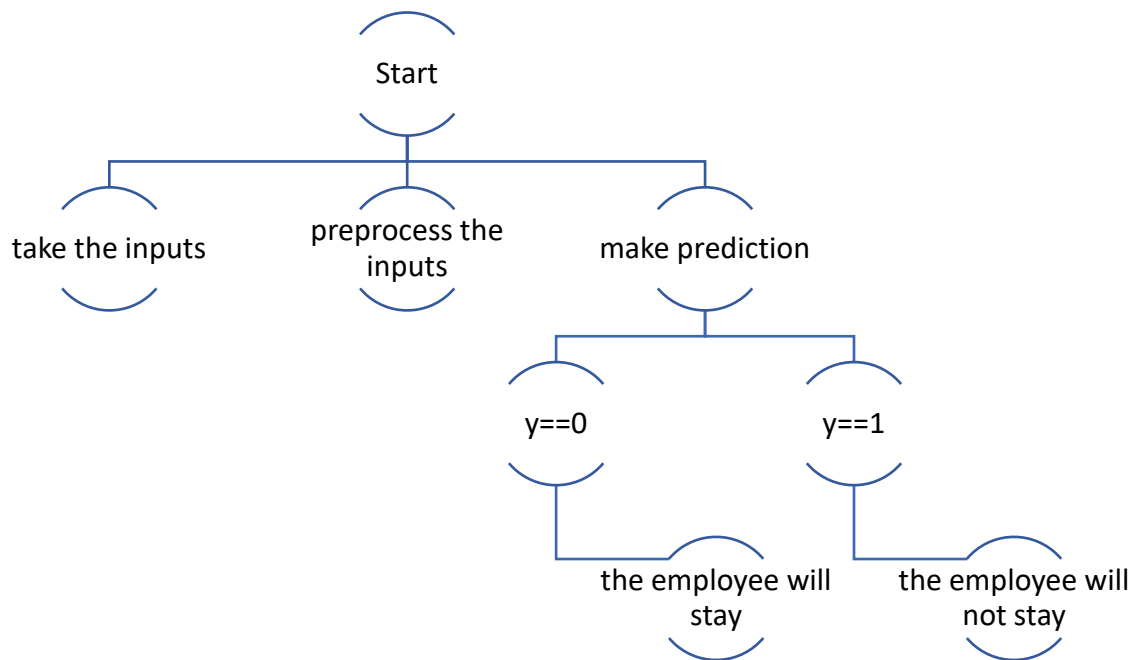
```
[1],
[0],
[1],
[0],
[0],
[0],
[0],
[1],
[0],
[0],
[0],
[0],
[1],
[1],
[0],
[0],
[0],
[1],
[0],
[0],
```

```
In [284]: #accuracy
from sklearn.metrics import accuracy_score
nbacc=accuracy_score(y_test,nbpred)
```



Jupyter notebook

## 5.FLOW CHART



## 6. RESULT

The screenshot shows a web application titled 'PREDICT' running on a browser at localhost:5000. The application features a dark-themed overlay with a background image of a modern office. The main heading is 'Know the future of your company!'. Below this, there are several input fields and sliders for user data:

- Choose an option:** Travel Rarely (dropdown)
- Department:** Sales (dropdown)
- Gender:** Male (dropdown)
- Marital Status:** Single (dropdown)
- Over Time:** Yes (dropdown)
- Performance Rating:** \*\*\* (dropdown)
- Age of the employee:** Slider (range 1 to 4)
- Distance from home:** Slider (range 1 to 4)
- Monthly Income:** Slider (range 1 to 4)
- Percent Salary Hike:** Slider (range 1 to 4)
- Total Working Years:** Slider (range 1 to 4)
- Years at company:** Slider (range 1 to 4)
- Years Since Last Promotion:** Slider (range 1 to 4)
- Environment Satisfaction:** Slider (range 1 to 4)
- Job Satisfaction:** Slider (range 1 to 4)
- Relationship Satisfaction:** Slider (range 1 to 4)

A 'Click Here!' button is located at the bottom of the form.

**Know the future of your company!**

Choose an option  Department  Gender

Marital Status  Over Time

Performance Rating

Age of the employee  Distance from home  Monthly Income  Percent Salary Hike

Total Working Years  Years at company  Years Since Last Promotion

Environment Satisfaction  1 4 Job Satisfaction  1 4 Relationship Satisfaction  1 4

[Click Here!](#)

The employee will stay.

## 7.ADVANTAGES AND DISADVANTAGES

### Advantages:

This model helps optimize company performances. In the model we have used Naïve Bytes with 73% accuracy. This is extremely good for a machine learning model which consists of so many categories.

### Disadvantage:

It is not exactly correct as the accuracy is only 73%.

## 8.APPLICATIONS:

This machine learning model can be used in all sorts of industries (technology, automobile). Wherever there is a company one can efficiently use this model.



## 9.CONCLUSION:

This model will be extremely effective and helpful if used at the right place at the right time. As described above Employee Attrition Prediction is beneficial in all sorts of industries and helps optimize the employer and employees experience in the company.

## 10.BIBLOGRAPHY:

<https://hr.toolbox.com/articles/what-is-attrition-complete-guide>

<https://harver.com/blog/employee-attrition-employee-turnover/>

<https://blog.vantagecircle.com/employee-attrition/>

## 11.SOURCE CODE:

```
<!DOCTYPE html>
```

```
<html>
```

```
<head>
```

```
    <link href="{{ url_for('static', filename='css/main.css') }}"  
rel="stylesheet">
```

```
</head>
```

```
<body>
```

```
<div class='navbar'>
```

```
<b>PREDICT<b>
```

```
<a href="{{url_for('stats')}}">Stats</a>
```

<a href="{{url\_for('about')}}" >About</a>

<a href="{{url\_for('home')}}">Home</a>

</div>

<div class='pred'>

<form action="/login" method="post">

<h1 style="font-size:25px; padding-top:35px; color:white;">Know the future of your company!</h1>

<span><label for="Business Travel">Choose an option</label>

<select name='bt'>

<option value="Travel\_Rarely">Travel Rarely</option>

<option value="Travel\_Frequently">Travel Frequently</option>

<option value="Non-Travel">Non-Travel</option>

</select></span>

<span><label for="Department">Department</label>

<select name='dept'>

<option value="Sales">Sales</option>

<option value="Research & Development">Research & Development</option>

<option value="Human Resources">Human Resources</option>

</select></span>

<span><label for="Gender">Gender</label>

<select name='gender'>

<option value="Male">Male</option>

<option value="Female">Female</option>

</select></span>

```
<span><label for="Marital Status">Marital Status</label>
<select name='ms'>
<option value="Single">Single</option>
<option value="Married">Married</option>
<option value="Divorced">Divorced</option>
</select></span>

<span><label for="Over Time">Over Time</label>
<select name='ot'>
<option value="Yes">Yes</option>
<option value="No">No</option>
</select></span>

<span><label for="Performance Rating">Performance Rating</label>
<select name='pr'>
<option value="3">***</option>
<option value="4">****</option>
</select></span>

<span><p>Age of the employee</p>
<p><input type='text' name='age'/></p></span>

<span><p>Distance from home</p>
<p><input type='text' name='distance'/></p></span>

<span><p>Monthly Income</p>
<p><input type='text' name='income'/></p></span>

<span><p>Percent Salary Hike</p>
<p><input type='text' name='percent'/></p></span>

<span><p>Total Working Years</p>
<p><input type='text' name='totalworkyear'/></p></span>
```

```
<span><p>Years at company</p>
<p><input type='text' name='years'/></p></span>
<span><p>Years Since Last Promotion</p>
<p><input type='text' name='promote'/></p></span>
<span><p>Environment Satisfaction</p>
<p>1<input type='range' min=1 max=4 name='es' value=1
step=1/>4</p></span>
<span><p>Job Satisfaction</p>
<p>1<input type='range' min=1 max=4 name='js' value=1
step=1/>4</p></span>
<span><p>Relationship Satisfaction</p>
<p>1<input type='range' min=1 max=4 name='rs' value=1
step=1/>4</p></span>

<p><input type='submit' value='Click Here!'/></p>
<b>{{y}}</b>
</form>

</div>
</body>
</html>
```

---

```
<!DOCTYPE html>
<html>
<head>
```

```
<style>
>
head
{
    background-color:#000;
}

h1{
font-family: sans-serif;
font-size:60px;
text-align:center;
}

p
{
color:turquoise;
font-size:30px;
}

</style>
</head>
<body>
<h1><b>About The Project</b></h1>
<div>
```

```
<p>This project is aimed to create better work environments which will
subsequently decrease the employee attrition. We are trying to help the
employees and employers simultaneously through our predictions. </p>
```

<p>The dataset contains attributes such as the time since last promotion, years of work in the company and so on to determine if the employee will stay or leave. We've also plotted graphs in order to see which sector loses most employees.</p>

</div>

</body>

</html>

---

<!DOCTYPE html>

<html>

<head>

<style>

img{

width:550px;

height:400px;

padding:10px;

margin-top:0px;

}

img:hover{

border-radius:100px;

border-color:grey;

border-shadow:10px;

}

body{

```
background-color:black;
```

```
}
```

```
h1{
```

```
font-size:60px;
```

```
text-align:center;
```

```
color:white;
```

```
font-style:italic;
```

```
font-weight:bolder;
```

```
}
```

```
div{
```

```
margin-left:50px;
```

```
}
```

```
</style>
```

```
</head>
```

```
<body>
```

```
<h1>Statistics</h1>
```

```
<div>
```

```
<span></span>
```

```
<span></span>
```

```
<span></span>
```

```
<span></span>
```

```
<div>
```

</body>

</html>