



# SC1015- Mini Project

Heart Attack Analysis and Computing  
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Team 7:FCE3

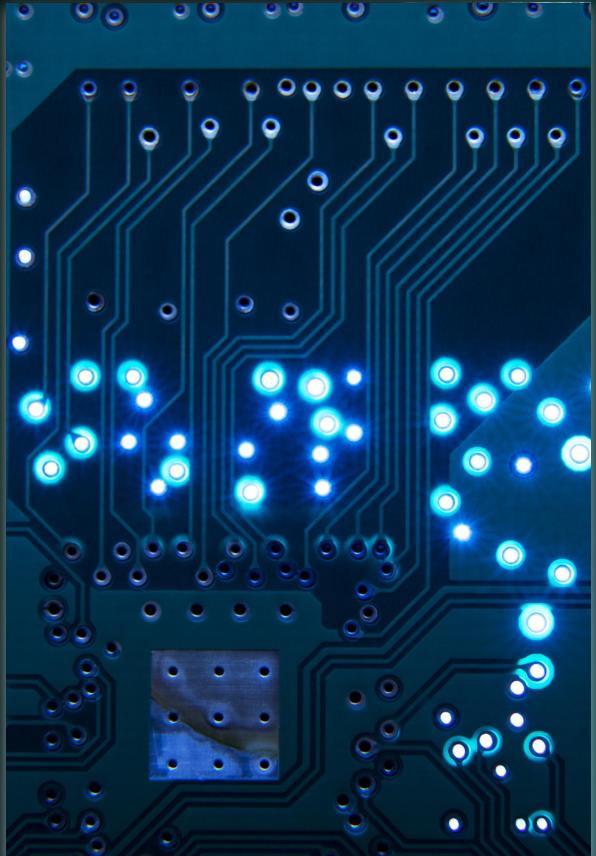
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# PRACTICAL MOTIVATION

## 01





# WORLD HEART REPORT 2023

## CONFRONTING THE WORLD'S NUMBER ONE KILLER

More than half a billion people around the world continue to be affected by cardiovascular diseases, which accounted for 20.5 million deaths in 2021<sup>1</sup> – close to a third of all deaths globally and an overall increase on the estimated 121 million CVD deaths.



# PROBLEM DEFINITION

- Exploratory analysis of variables and Feature selection to statistically rank the features contributing to the risk of a heart attack.
- Computing the accuracies of two machine learning models and comparing on the basis of 13,8 and 3 variables.

# INTRODUCING OUR DATASET

**age** Age of the Patient

**trtbps** Resting blood pressure (in mm Hg)

**chol** Cholesterol in mg/dl fetched via BMI sensor

**thalachh** Maximum heart rate achieved

**caa** Number of Major Vessels Coloured by Fluoroscopy

# INTRODUCING OUR DATASET

**sex** Sex of the Patient

**cp** Chest Pain Type

**fbs** Fasting Blood Sugar > 120mg/dl

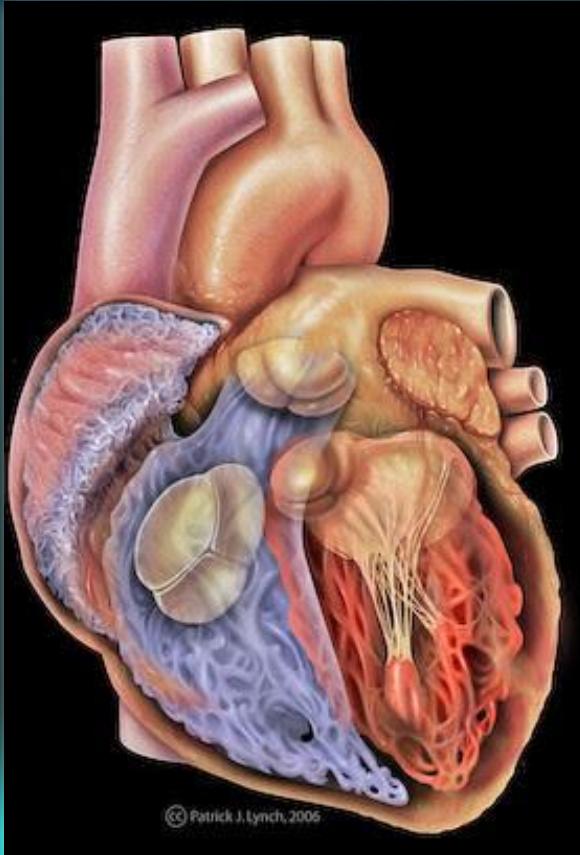
**restecg** Resting Electrocardiographic Results

**oldpeak** Previous Peak

**exng** Exercise Induced Angina

**thall** Thallium Stress Test Result

**slop** Slope



# TARGET VARIABLE

"Output" Variable: Heart Attack Occurrence

- **1: Heart Attack Occurred**
  - Indicates that the individual experienced a heart attack.
- **0: No Heart Attack**
  - Indicates that the individual did not experience a heart attack.

# 02

## EXPLORATORY DATA ANALYSIS

- *Data Cleaning*
- *Categorical visualization*
- *Numeric visualisation*
- *Feature selection*



# DATA CLEANING

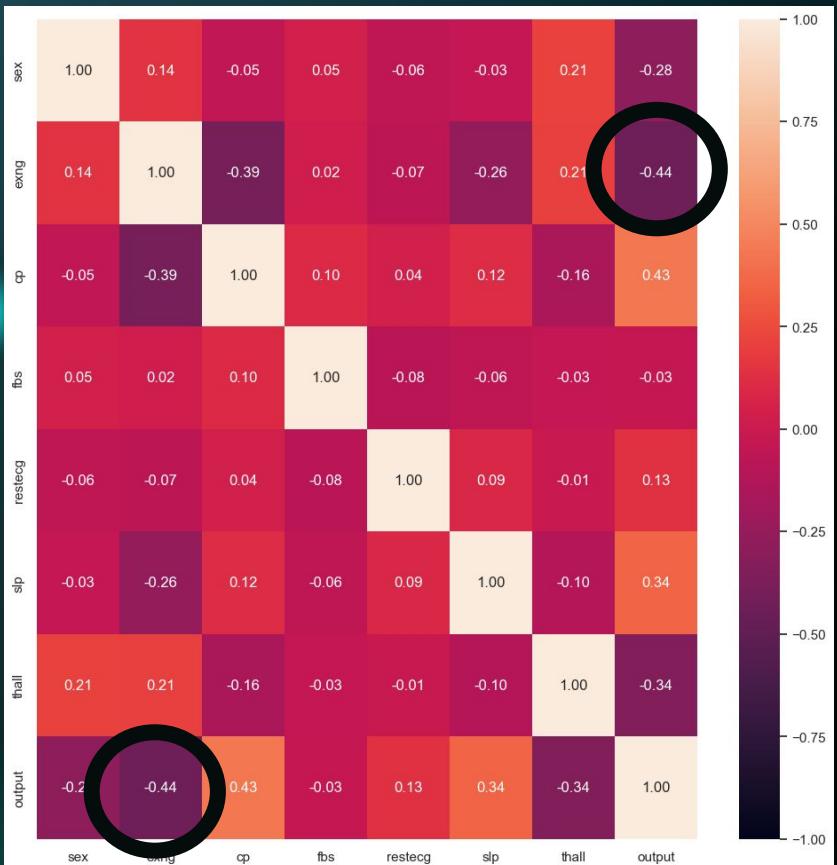
```
In [67]: heartData[heartData.duplicated()]
```

Out[67]:

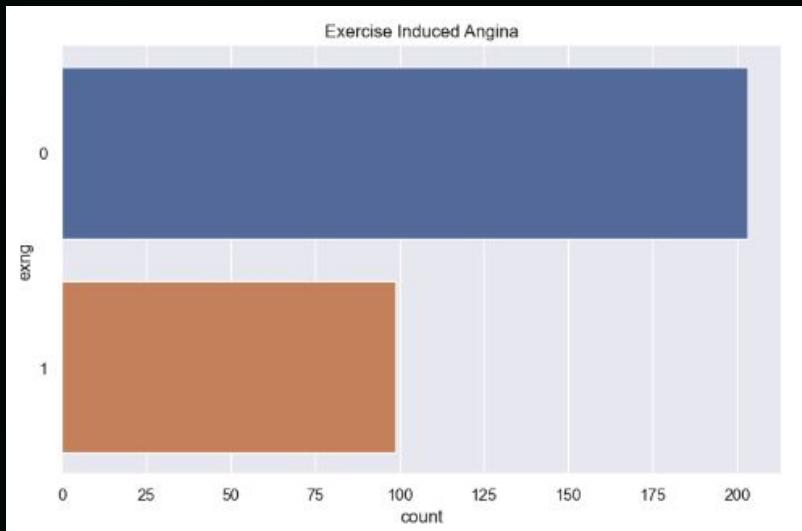
	age	sex	cp	trtbps	chol	fbs	restecg	thalachh	exng	oldpeak	slp	caa	thall	output	
	164	38	1	2	138	175	0	1	173	0	0.0	2	4	2	1

```
In [68]: heartData.drop_duplicates(keep='first', inplace=True)
```

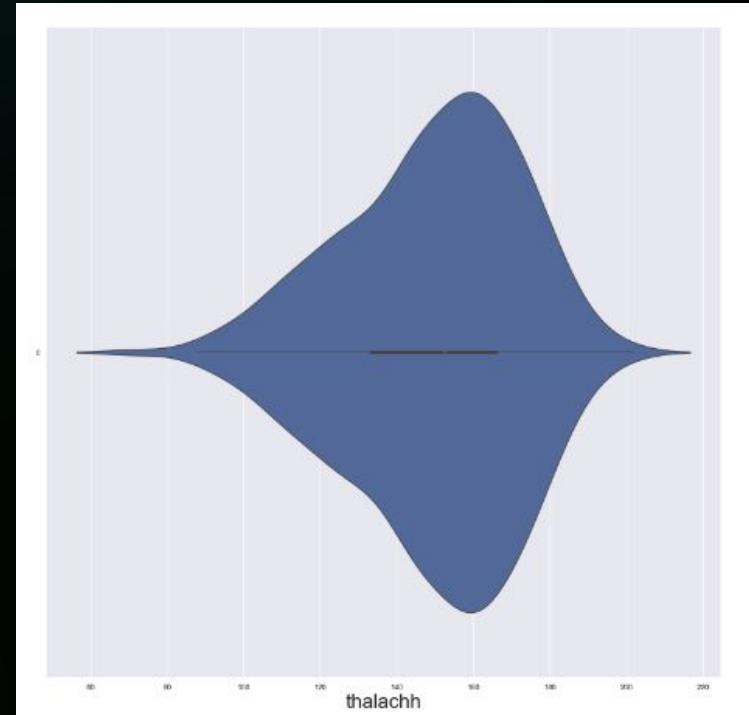
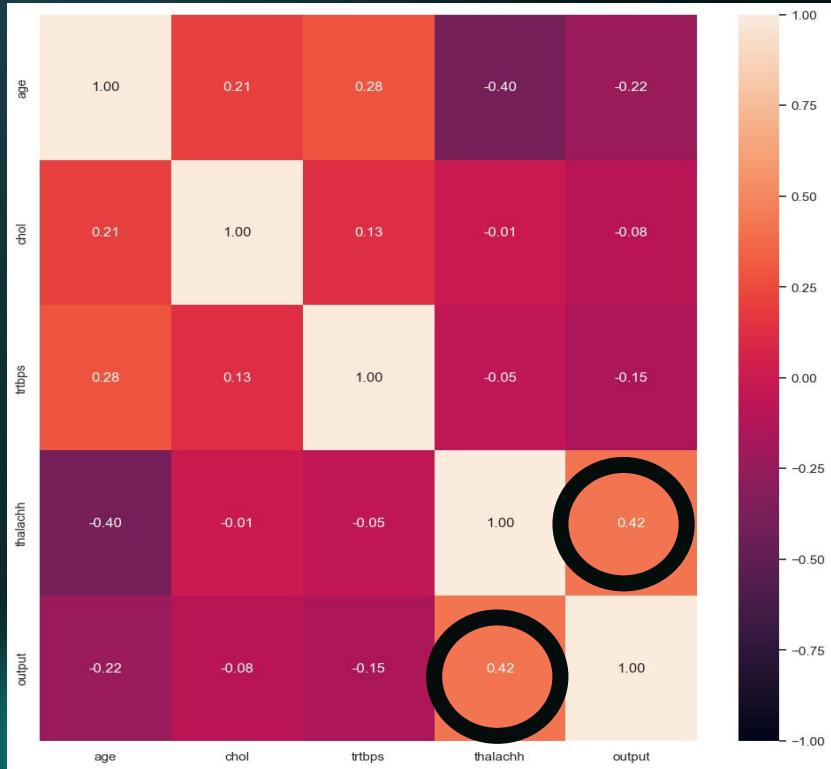
We found one duplicate value and hence have dropped it.



# CATEGORICAL VISUALISATION



# NUMERIC VISUALISATION



# FEATURE SELECTION

```
Logistic Regression Accuracy: 0.8524590163934426
Logistic Regression Classification Report:
      precision    recall   f1-score   support
          0         0.86     0.83     0.84      29
          1         0.85     0.88     0.86      32

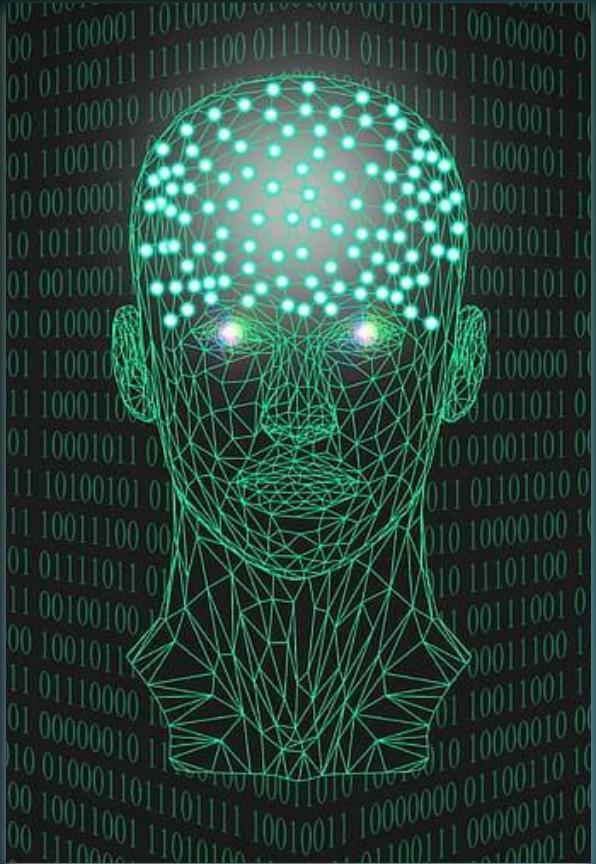
      accuracy           0.85      61
      macro avg       0.85     0.85     0.85      61
  weighted avg       0.85     0.85     0.85      61

Feature Importance using Logistic Regression:
      Feature  Coefficient
  1       sex     -1.172798
  12      thall    -1.142387
  11      caa     -0.769140
  8       exng    -0.730590
  2       cp      0.696413
  10      slp      0.656893
  6      restecg   0.546694
  9      oldpeak   -0.480931
  5       fbs      0.076861
  7      thalachh   0.033457
  3      trtbps   -0.021249
  0       age      0.020281
  4       chol     -0.002199
```

# 03

## MACHINE LEARNING

- *Random Forest*
- *Gradient Boosting*



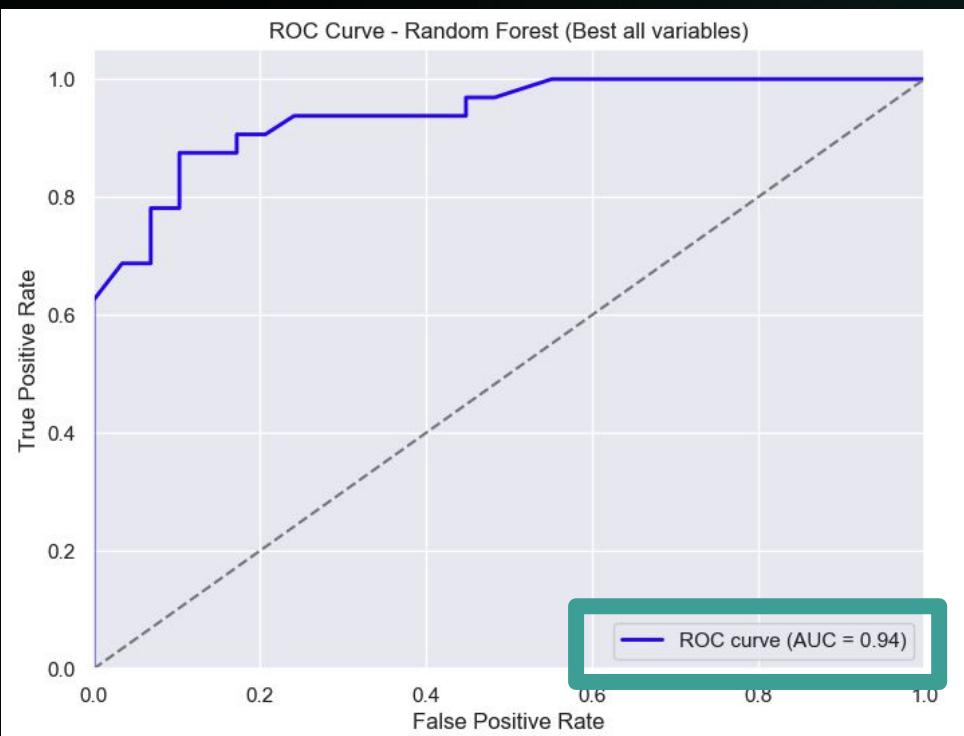
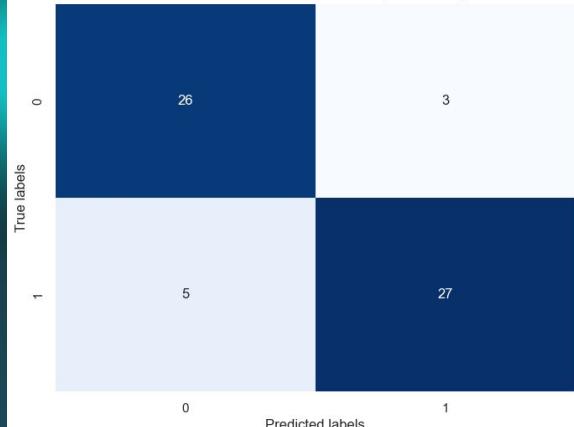
# RANDOM FOREST CLASSIFIER

Random Forest Accuracy (All variables): 0.8688524590163934

Random Forest Classification Report (All variables):

	precision	recall	f1-score	support
0	0.84	0.90	0.87	29
1	0.90	0.84	0.87	32
accuracy			0.87	61
macro avg	0.87	0.87	0.87	61
weighted avg	0.87	0.87	0.87	61

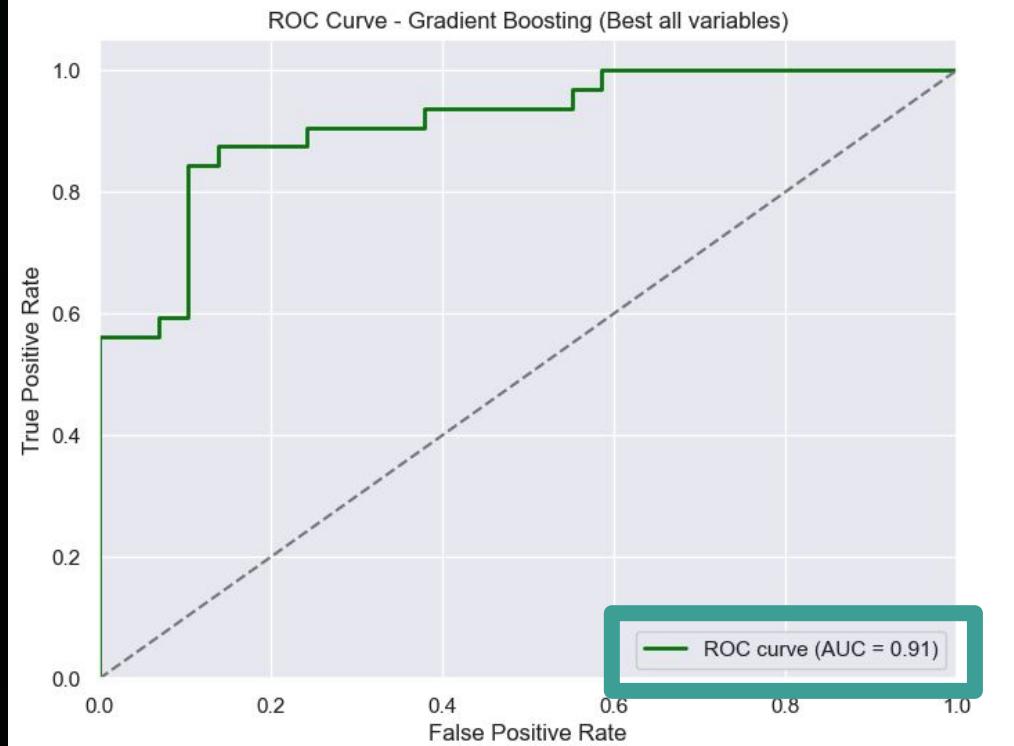
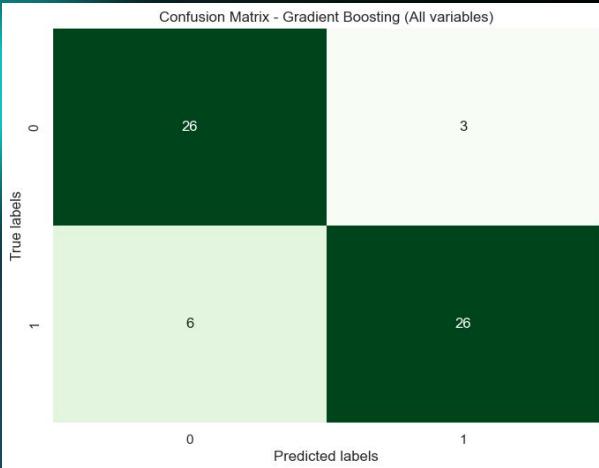
Confusion Matrix - Random Forest (All variables)



# GRADIENT BOOSTING

Gradient Boosting Accuracy (All variables): 0.8524590163934426  
Gradient Boosting Classification Report (All variables):

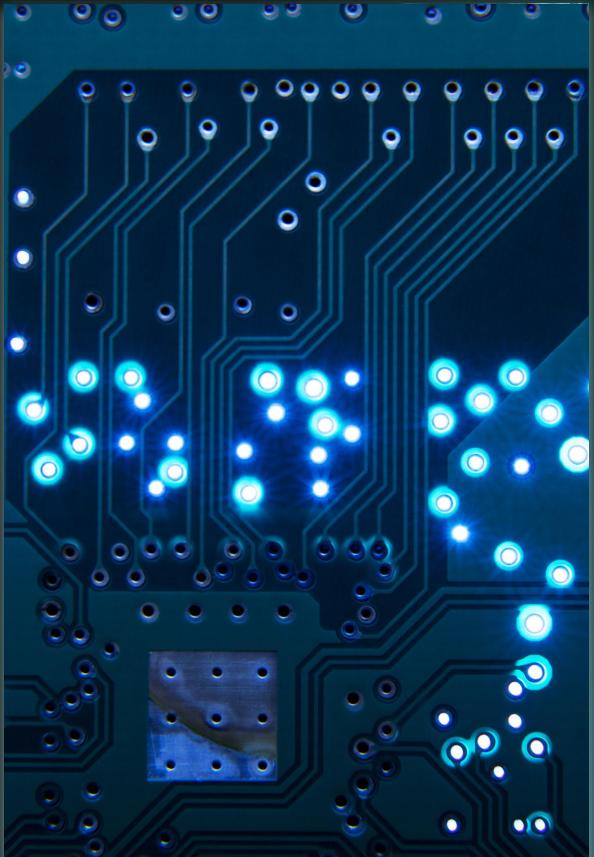
	precision	recall	f1-score	support
0	0.81	0.90	0.85	29
1	0.90	0.81	0.85	32
accuracy			0.85	61
macro avg	0.85	0.85	0.85	61
weighted avg	0.86	0.85	0.85	61



---

# FINAL INSIGHTS

# 06



# FINAL OBSERVATIONS

- Both Random Forest and Gradient Boosting **perform well**.
- Models trained with fewer variables have **slightly lower performance**.
- Random Forest achieves **higher AUC scores** compared to Gradient Boosting.
- Precision and recall are well balanced across classes for most models.



# COURSE OF ACTION

Through our exploratory data analysis, we have received multiple observations.

In order to come to a conclusion from our observation, we performed **correlation analysis**.

The analysis of all the variables allowed us to perceive the variable which has the **highest correlation with the 'target' variable**.

We note down those variables and **compare** with the feature selection.

Through the machine learning model of **logistic regression**, feature selection is performed.

The second machine learning model, the **Random Forest Classifier** is implemented based on the feature selection

The third machine learning model, the **Gradient Boosting** is implemented based on feature selection

**Comparison of the accuracy** of the two models

Therefore, coming to the conclusion which model is **better**.

# THANKS!

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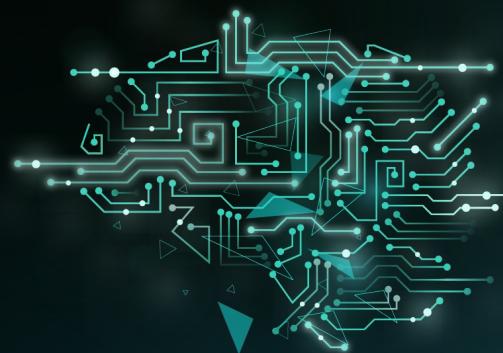
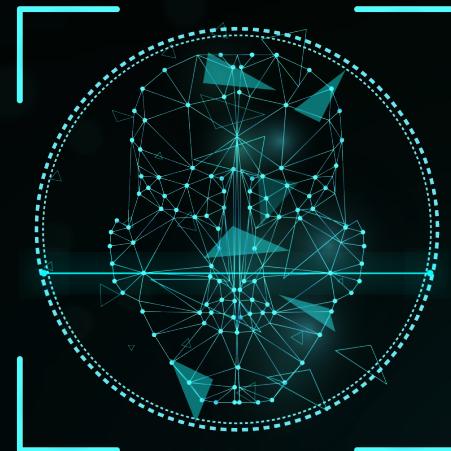
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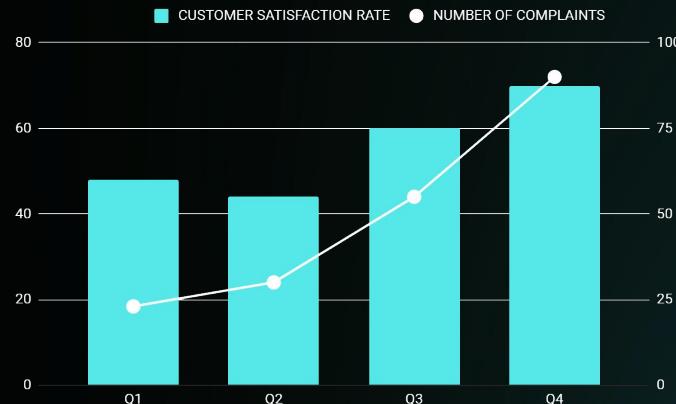
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RESOURCE	UTILIZATION RATE	COST PER UNIT
Labor	85%	\$50
Equipment	70%	\$100
Materials	95%	\$20
Rent	90%	\$1,000
Energy	80%	\$80
Software licenses	80%	\$200
Advertising	60%	\$500



**120 U/DAY**

Output per worker

**2H**

Time to complete a task

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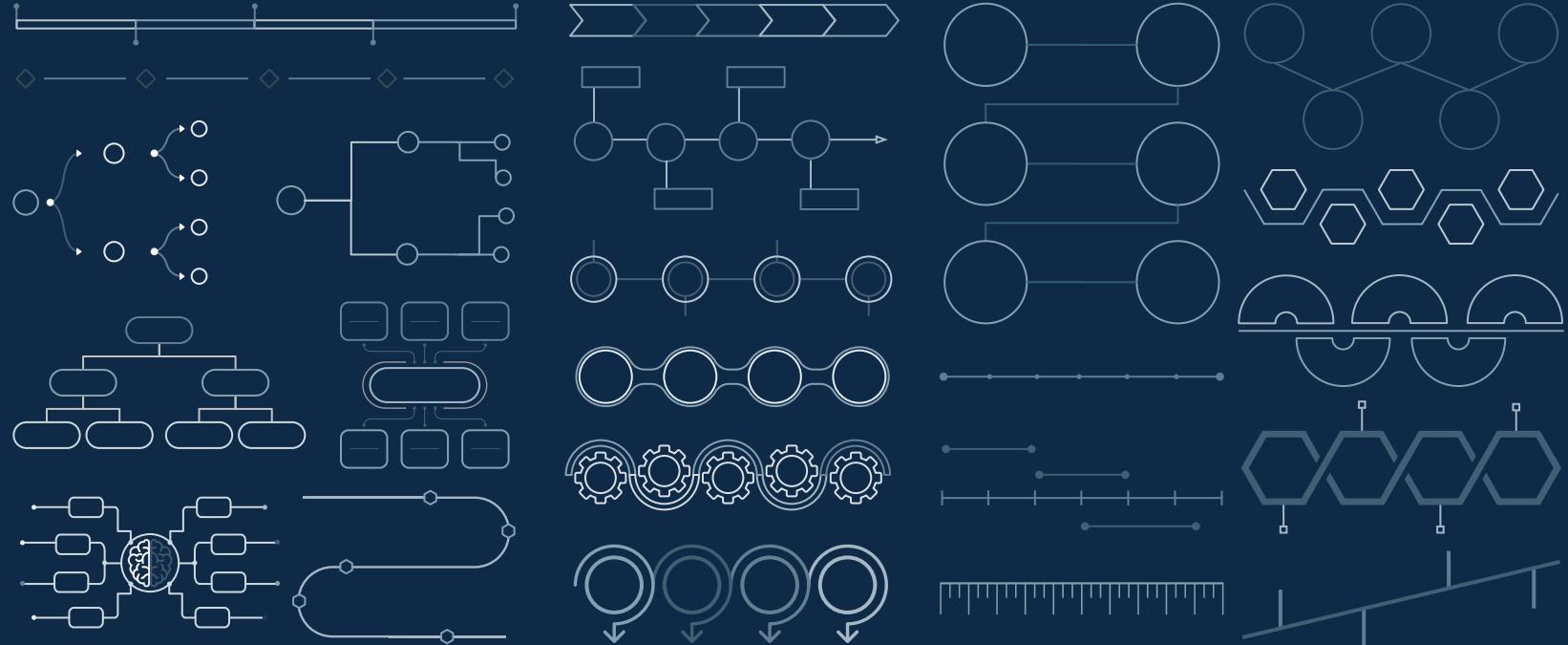
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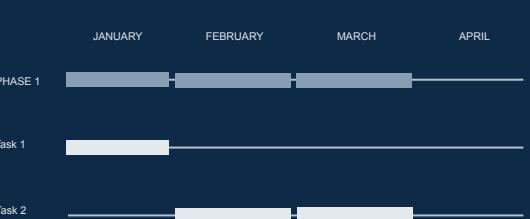
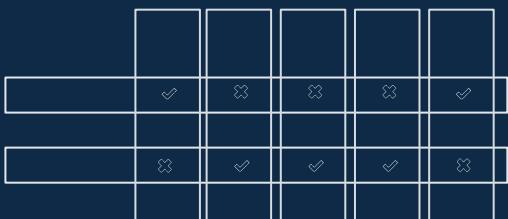
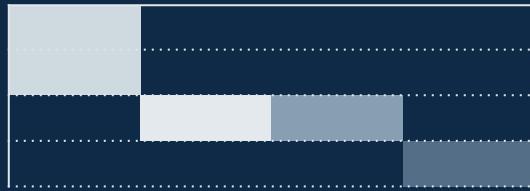
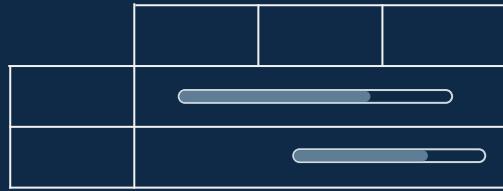
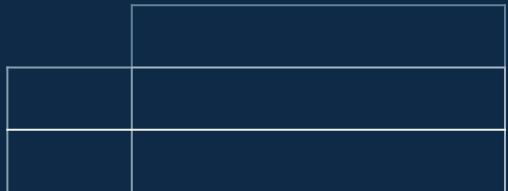
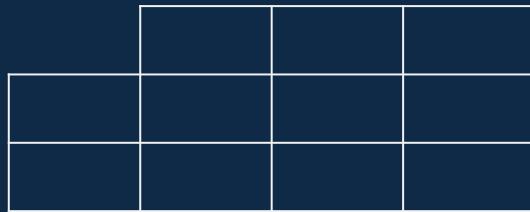
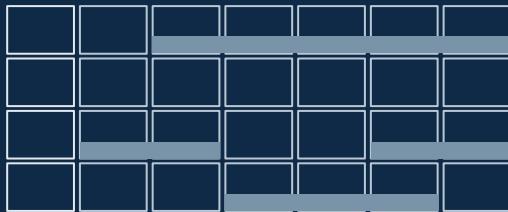
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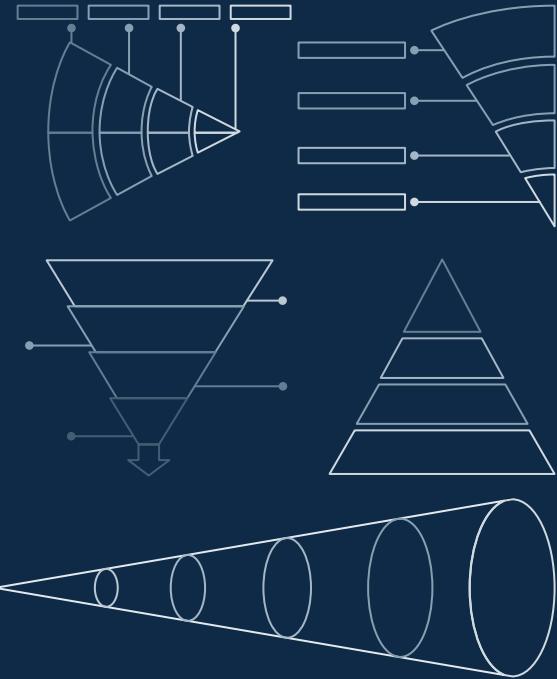
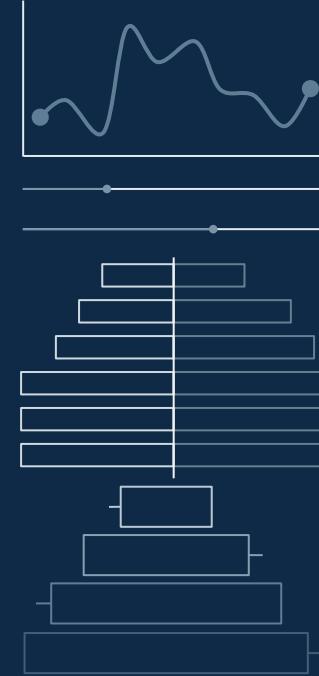
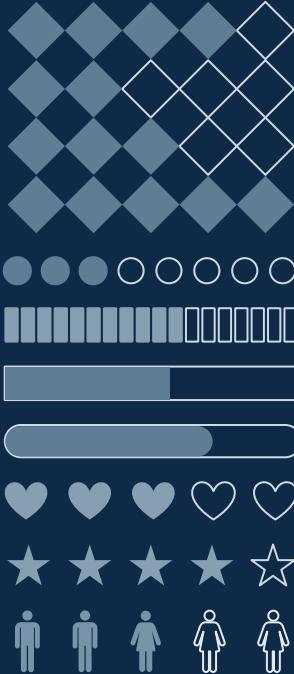
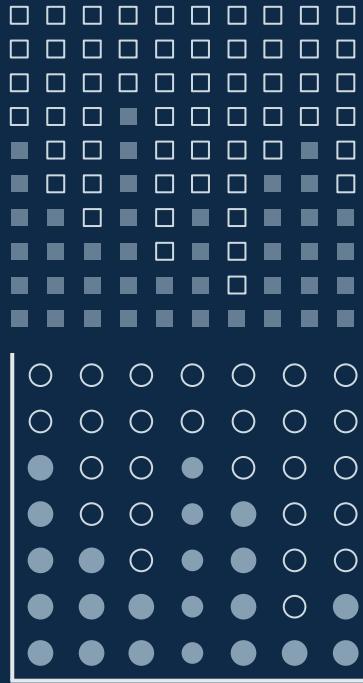












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