# Diabetes Classification Model

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# Type 2 Diabetes

An estimated 34.2 million people have diabetes (10.5 percent of the U.S. population).

- An estimated 7.3 million adults ages 18 years or older have diabetes but are undiagnosed (21.4 percent of adults with diabetes).

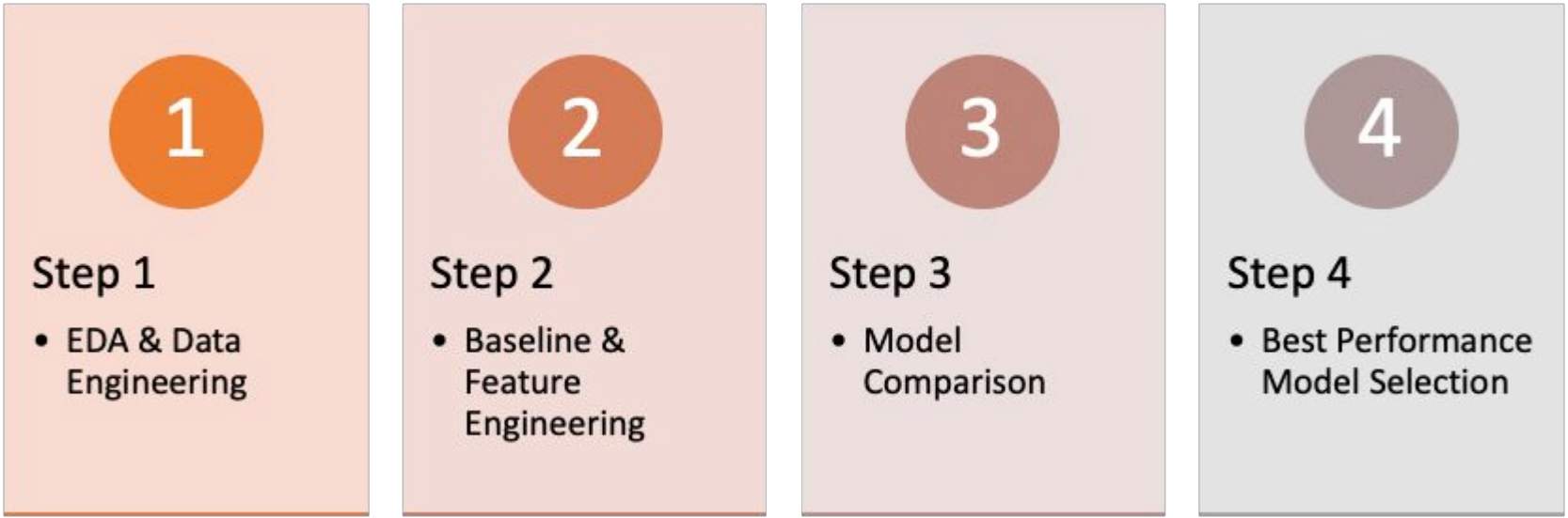
**Data:** 250K Data points obtained from the Behavioral Risk Factor Surveillance System (BRFSS) a health-related telephone survey that is collected annually by the CDC.

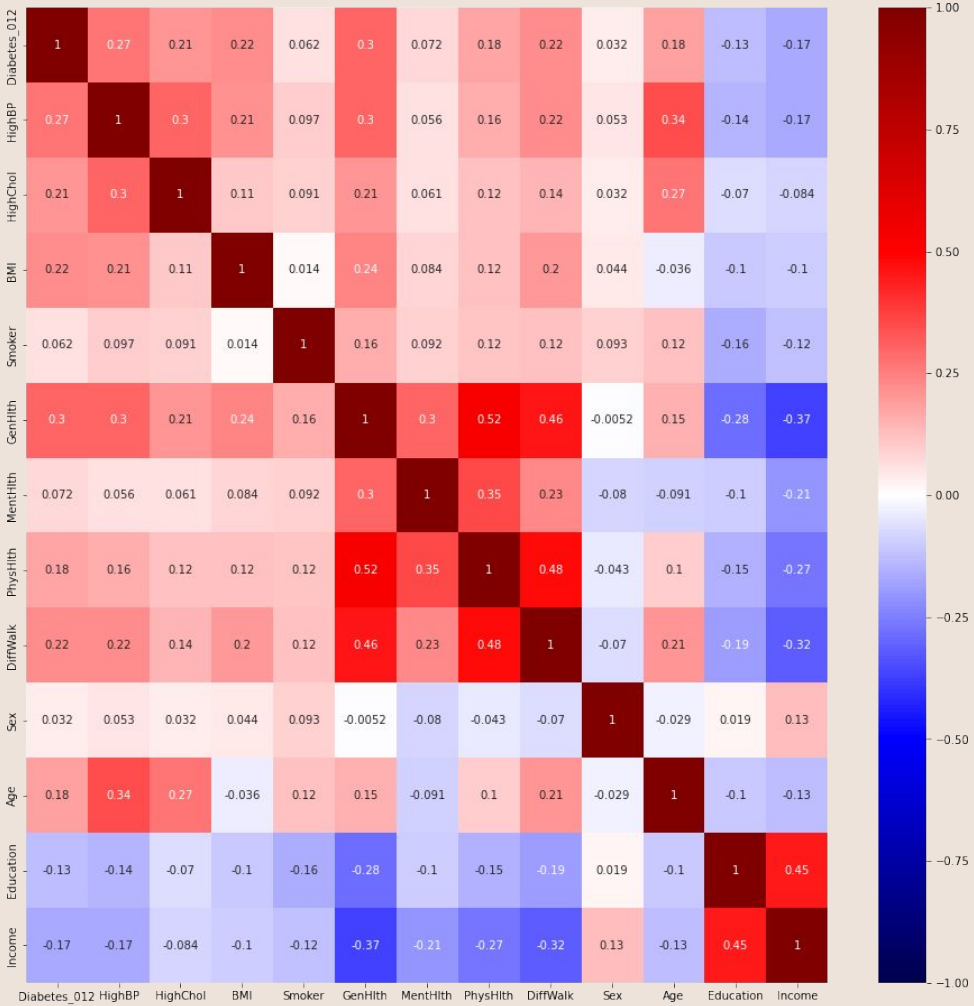
**Target:** Build a classification model that can diagnose whether or not an individual has diabetes.

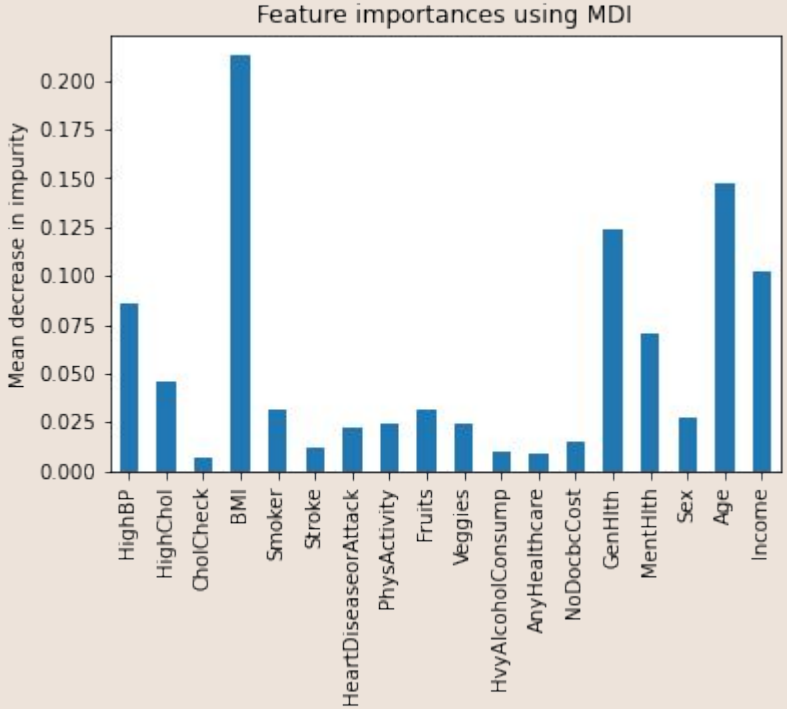
# Features


- High Blood Pressure
- High Cholesterol
- Cholesterol Check
- Body Mass Index
- Smoker
- Stroke
- Heart Disease or Attack
- Physical Activity
- Fruits
- Veggies
- Heavy Alcohol Consumption
- Any Healthcare
- No Doctor because of cost
- General Health
- Mental Health
- Physical Health
- Difficulty Walking
- Sex
- Age
- Education
- Income

# Can we predict if someone has Diabetes?




Diabetes_012 1 0.27 0.21 0.22 0.062 0.3 0.072 0.18 0.22 0.032 0.18 -0.13 -0.17
HighBP 0.27 1 0.3 0.21 0.097 0.3 0.056 0.16 0.22 0.053 0.34 -0.14 -0.17
HighChol 0.21 0.3 1 0.11 0.091 0.21 0.061 0.12 0.14 0.032 0.27 -0.07 -0.084
BMI 0.22 0.21 0.11 1 0.014 0.24 0.084 0.12 0.2 0.044 -0.036 -0.1 -0.1
Smoker 0.062 0.097 0.091 0.014 1 0.16 0.092 0.12 0.12 0.093 0.12 -0.16 -0.12
GenHlth 0.3 0.3 0.21 0.24 0.16 1 0.3 0.52 0.46 -0.0052 0.15 -0.28 -0.37
MentHlth 0.072 0.056 0.061 0.084 0.092 0.3 1 0.35 0.23 -0.08 -0.091 -0.1 -0.21
PhysHlth 0.18 0.16 0.12 0.12 0.12 0.52 0.35 1 0.48 -0.043 0.1 -0.15 -0.27
DiffWalk 0.22 0.22 0.14 0.2 0.12 0.46 0.23 0.48 1 -0.07 0.21 -0.19 -0.32
Sex 0.032 0.053 0.032 0.044 0.093 -0.0052 -0.08 -0.043 -0.07 1 -0.029 0.019 0.13
Age 0.18 0.34 0.27 -0.036 0.12 0.15 -0.091 0.1 0.21 -0.029 1 -0.1 -0.13
Education -0.13 -0.14 -0.07 -0.1 -0.16 -0.28 -0.1 -0.15 -0.19 0.019 -0.1 1 0.45
Income -0.17 -0.17 -0.084 -0.1 -0.12 -0.37 -0.21 -0.27 -0.32 0.13 -0.13 0.45 1
Diabetes_012 HighBP HighChol BMI Smoker GenHlth MentHlth PhysHlth DiffWalk Sex Age Education Income
1.00 0.75 0.50 0.25 0.00 −0.25 −0.50 −0.75 −1.00


Feature importances using MDI
Mean decrease in impurity
0.200 0.175 0.150 0.125 0.100 0.075 0.050 0.025 0.000
HighBP HighChol CholCheck BMI Smoker Stroke HeartDiseaseorAttack PhysActivity Fruits Veggies HvyAlcoholConsump AnyHealthcare NoDocbcCost GenHlth MentHlth Sex Age Income

# Classification Algorithms Validation Metrics

**K Nearest Neighbors**

- Accuracy: 0.7673
- Precision: 0.3128
- Recall: 0.5360
- F1: 0.3951
- Cross Validation Accuracy Score : 0.77854

**Random Forest:**

- Accuracy: 0.7698
- Precision: 0.3488
- Recall: 0.7195
- F1: 0.4698
- Cross Validation Accuracy Score: 0.80256

**Logistic Regression:**

- Accuracy: 0.7896
- Precision: 0.3639
- Recall: 0.6476
- F1: 0.4659
- Cross Validation Accuracy Score : 0.74455

**Stacking Ensembling:**

- Accuracy: 0.8623
- Precision: 0.5388
- Recall: 0.1988
- F1: 0.2905
- Cross Validation Accuracy Score: 0.92498

**Decision Tree:**

- Accuracy: 0.7699
- Precision: 0.3330
- Recall: 0.6218
- F1: 0.4337
- Cross Validation Accuracy Score: 0.71748

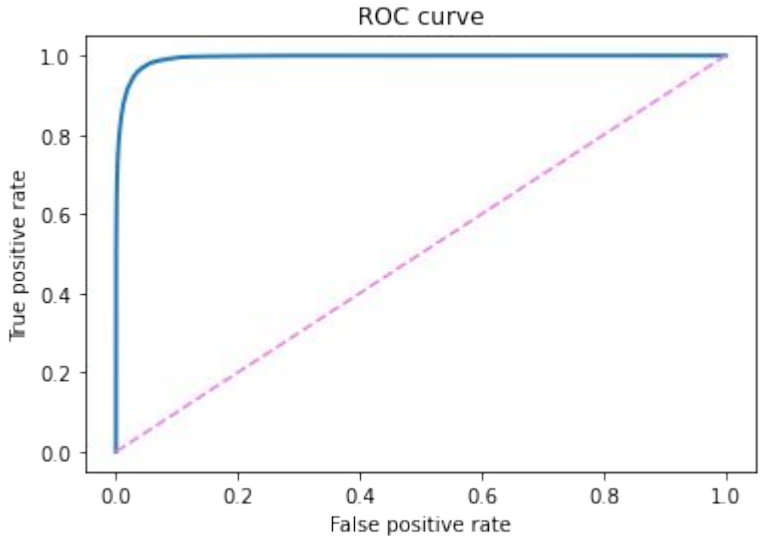
**Voting Ensembling:**

- Accuracy: 0.7974
- Precision: 0.3560
- Recall: 0.5296
- F1: 0.4258
- Cross Validation Accuracy Score: 0.8623

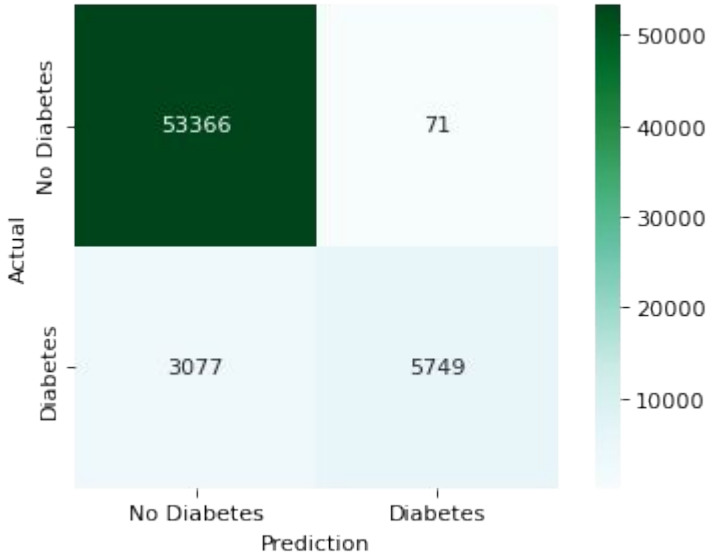
# Hyperparameter Tuning

| First Model | Second Model | Third Model | Best Model |
|---|---|---|---|
| **Accuracy:** 0.7698 | **Accuracy:** 0.8201 | **Accuracy:** 0.8312 | **Accuracy:** 0.8295 |
| **Precision:** 0.3488 | **Precision:** 0.3440 | **Precision:** 0.3881 | **Precision:** 0.3963 |
| **Recall:** 0.7195 | **Recall:** 0.2969 | **Recall:** 0.3310 | **Recall:** 0.3869 |
| **F1:** 0.4698 | **F1:** 0.3187 | **F1:** 0.3572 | **F1:** 0.3915 |
| **Cross Validation Accuracy Score:** 0.80256 | **Cross Validation Accuracy Score:** 0.92541 | **Cross Validation Accuracy Score:** 0.91561 | **Cross Validation Accuracy Score:** 0.91611 |

# Best Performance Model: Random Forest




ROC AUC Score = 0.99427



# Questions