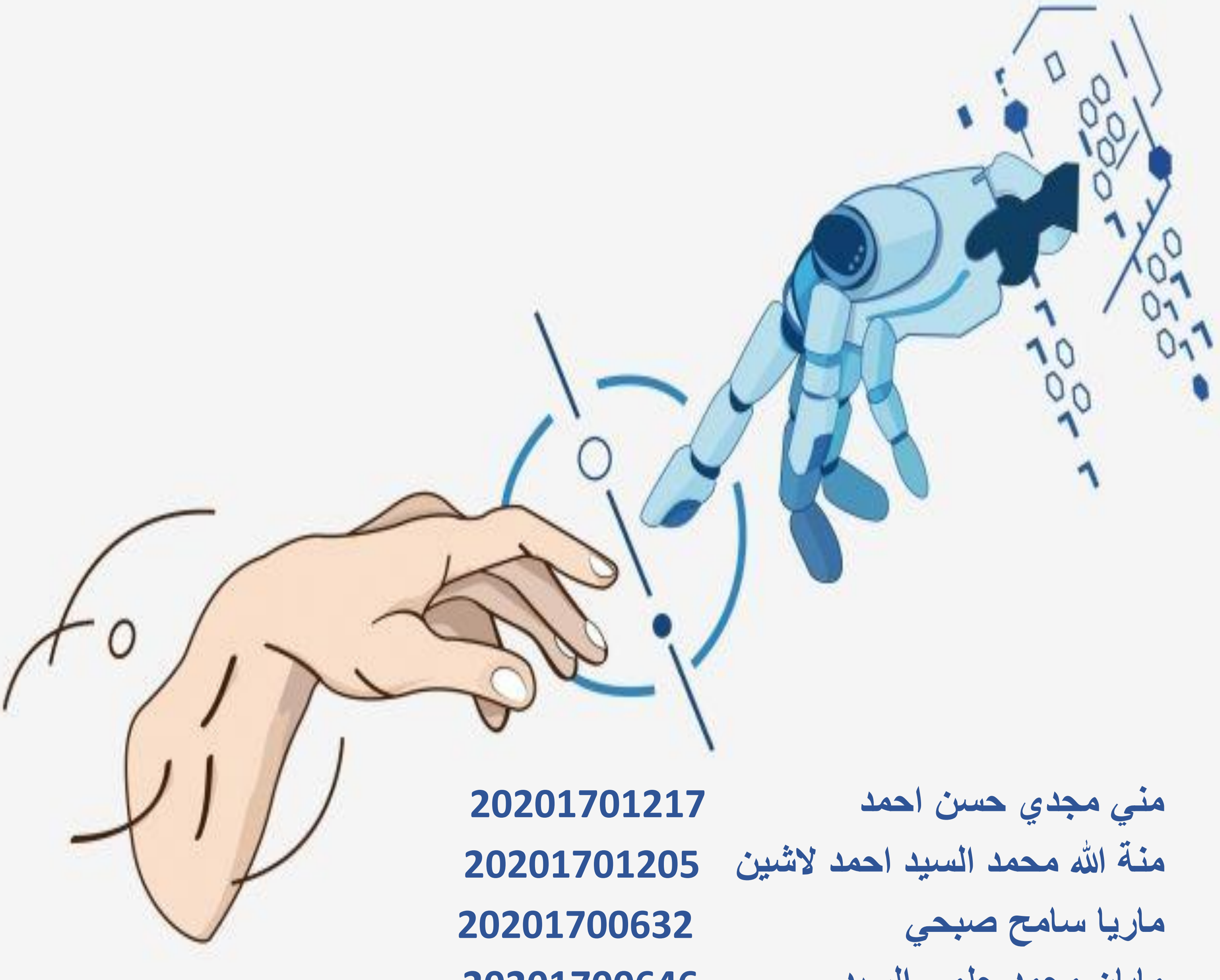
Diabetes Health Indicators



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Project Brief:

-Diabetes mellitus is one of the most serious illnesses in the world.
-Project goal: predict whether a person has diabetes or not, if he does, then the output (Diabetes _binary) will be 1 and if not, then the output will be 0.

Preprocessing:

Data collection:

Data is read from: **diabetes _ binary _ health _ indicators _ BRFSS2015.csv**

Data cleansing:

drop_duplicates(): function is used to remove any duplicates rows.

isnull().sum(): to check if the data contains null values or not.

```
null values are
 Diabetes_binary         0
HighBP                  0
HighChol                0
CholCheck               0
BMI                     0
Smoker                  0
Stroke                  0
HeartDiseaseorAttack    0
PhysActivity            0
Fruits                  0
Veggies                 0
HvyAlcoholConsump       0
AnyHealthcare           0
NoDocbcCost             0
GenHlth                 0
MentHlth                0
PhysHlth                0
DiffWalk                0
Sex                     0
Age                     0
Education               0
Income                  0
```

Feature extraction:

-Features are selected by calculating their correlation then selecting features with correlation greater than 0.17, then it's visualized using heatmap.

Data Scaling:

-It is a technique used to **standardize** the independent features present in the data **within a fixed range**. It is performed during the data pre-processing to handle highly varying values.

- **Method Used**:

Standardization: It is a technique that re-scales a feature value so that it has distribution with 0 mean value and variance equals to 1.

```
# Datascaling by standard scaler
from sklearn.preprocessing import StandardScaler
fig, ax = plt.subplots(figsize=(12, 4))
scaler=StandardScaler()
ssx=scaler.fit_transform(x)
ax.scatter(ssx[:,0],y)
ax.scatter(ssx[:,1],y)
plt.title( "scatter plot of standard scaler")
plt.show()
```

Balancing Dataset:

- Imbalanced data refers to those types of datasets where the target class has an uneven distribution of observations i.e., one class label has a very high number of observations and the other has a very low number of observations.

- Oversampling can be performed by increasing the amount of minority class instances or samples with producing new instances or repeating some instances.

```
# Balancing
from collections import Counter
print("...............................................................................")
print(f"Training target statistics before oversampling: {Counter(y_train)}")
from imblearn.over_sampling import RandomOverSampler
over_sampler = RandomOverSampler(random_state=42)
X_res, y_res = over_sampler.fit_resample(x_train, y_train)
print(f"Training target statistics after oversampling: {Counter(y_res)}")
```

Imported libraries:

1)matplotlib: To draw the figure and figure function is used to determine figure size
2) seaborn: To draw heatmap
3)joblib: To load and save the model

Model Training:

Logistic regression:

- ✓ The **logistic regression** model is used to solve classification problems, and deals with discrete values and data.
- ✓ For the small data**: liblinear** solver (identify the size of dataset) is used, while for the big data: **sag/saga** solver is used.
- ✓ Most important functions:
  - **Fit()**: Pass training data as parameters.
  - **Predict()**
  - **Score():** Calculate accuracy.
- ✓ **Accuracy:** 86.53%
- ✓ **Precision, recall, f1_score:**

	precision	recall	f1-score
0.0	0.8787	0.9789	0.9261
1.0	0.5409	0.1551	0.2410

```
# # training and fitting Logistic Regression to model
 from sklearn.linear_model import LogisticRegression

 lr = LogisticRegression(solver="saga", random_state=0)
 lr.fit(x_train, y_train)

# # Saving model into a file
 joblib.dump(lr,'logistic_regression_model')

# Loading the model
lr_loaded = joblib.load("logistic_regression_model")
# Making predicition on logisitic regression
lr_pre = lr_loaded.predict(x_test)
# Calculating accuracy of logisitic regression
accuracy = lr_loaded.score(x_test, y_test)
print("accuracy of lr= ", accuracy * 100, "%")
# Making confusion matrix on logisitic regression
from sklearn.metrics import confusion_matrix

cm = confusion_matrix(y_test, lr_pre)
print(cm)
h = sns.heatmap(cm, annot=True, cmap="RdYlGn", fmt="d")
plt.xlabel("Predicted values")
plt.ylabel("Actual values")
plt.show()
```

Support vector machine (SVM):

- ✓ **SVM** is a binary classification model whose basic model is a linear classifier defined in the eigenspace with the largest interval.
- ✓ **Linear SVC** (Straight lines are used to divide data into different classes.) is used in this module.
- ✓ **Accuracy:** 86.39%
- ✓ **Precision, recall, f1_score:**

	precision	recall	f1-score
0.0	0.8684	0.9925	0.9263
1.0	0.5618	0.0597	0.1080

```
# # training and fitting SVM to model
 from sklearn.svm import LinearSVC

 sv = LinearSVC()
sv.fit(x_train, y_train)

# # Saving model into a file
 joblib.dump(sv,'svm_model')

# Loading the model
sv_loaded = joblib.load("svm_model")
# Making prediction of svm
svm_pre = sv_loaded.predict(x_test)
print(svm_pre.shape)
# calculating accuracy of svm
accuracy = sv_loaded.score(x_test, y_test)
print("accuracy of svm= ", accuracy * 100, "%")
# Making confusion matrix on svm
cmofsvm = confusion_matrix(y_test, svm_pre)
print(cmofsvm)
h = sns.heatmap(cmofsvm, annot=True, cmap="RdYlGn", fmt="d")
plt.xlabel("Predicted values")
plt.ylabel("Actual values")
plt.show()
```

Decision tree:

ID3 Algorithm: Using this method, decision trees are built iteratively by finding out the maximum Information Gain among all the featured data columns to be represented as the node of the tree.

-Information gain is considered as Entropy "Errors" reduction.

-As Information gain increases, Entropy decreases.

- ✓ **Accuracy:** 84.3%
- ✓ **Precision, recall, f1_score:**

	precision	recall	f1-score
0.0	0.8819	0.9440	0.9119
1.0	0.3746	0.2097	0.2689

```
# # training and fitting Decision tree to model
 from sklearn.tree import DecisionTreeClassifier

 dt = DecisionTreeClassifier()
 print(dt.fit(x_train, y_train))

# # Saving model into a file
 joblib.dump(dt,'decision_tree_model')

# Loading model
dt_loaded = joblib.load("decision_tree_model")

# Making predictions on decision tree
dt_pre = dt_loaded.predict(x_test)
print(dt_pre.shape)
# calculating accuracy of decision tree
accuracy = dt_loaded.score(x_test, y_test)
print("accuracy of dt = ", accuracy * 100, "%")
# Making confusion matrix on decision tree
cmofdt = confusion_matrix(y_test, dt_pre)
print(cmofdt)
h = sns.heatmap(cmofdt, annot=True, cmap="RdYlGn", fmt="d")
plt.xlabel("Predicted values")
plt.ylabel("Actual values")
plt.show()
```