```
REGRESSION
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968

REGRESSION


ITERATION   0
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968



ITERATION   1
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968



ITERATION   2
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968



ITERATION   3
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968



ITERATION   4
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968
```

```
ITERATION   5
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968


ITERATION   6
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968


ITERATION   7
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968


ITERATION   8
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968


ITERATION   9
A = 0.82
B = -12.609
Bias= 1661.757
X= [1 1]
Y= 1649.968


TENSOR FLOW


ITERATION   0
A = 0.806
B = 0.062
Bias= 1.881
```

```
X= [1 1]
Y= [2.748]


ITERATION  1
A = 0.816
B = -1.697
Bias= -1.0
1/1 ─────────────────────────── 0s 59ms/step
X= [1 1]
Y= [-1.881]


ITERATION  2
A = 0.819
B = -1.686
Bias= -0.995
1/1 ─────────────────────────── 0s 85ms/step
X= [1 1]
Y= [-1.862]


ITERATION  3
A = 0.825
B = -3.112
Bias= 1.454
1/1 ─────────────────────────── 0s 67ms/step
X= [1 1]
Y= [-0.833]


ITERATION  4
A = 0.826
B = -3.094
Bias= 1.443
1/1 ─────────────────────────── 0s 78ms/step
X= [1 1]
Y= [-0.825]


ITERATION  5
A = 0.826
B = -3.107
Bias= 1.444
1/1 ─────────────────────────── 0s 53ms/step
X= [1 1]
Y= [-0.837]
```

```
ITERATION  6
A = 0.818
B = -1.681
Bias= -0.999
1/1 ─────────────────────── 0s 59ms/step
X= [1 1]
Y= [-1.862]


ITERATION  7
A = 0.811
B = -0.31
Bias= 2.855
1/1 ─────────────────────── 0s 136ms/step
X= [1 1]
Y= [3.356]


ITERATION  8
A = 0.819
B = -1.678
Bias= 1.0
1/1 ─────────────────────── 0s 186ms/step
X= [1 1]
Y= [0.141]


ITERATION  9
A = 0.808
B = -0.293
Bias= 2.865
1/1 ─────────────────────── 0s 172ms/step
X= [1 1]
Y= [3.38]

here is i ..... TARGET_BAD_FLAG  ..... and here is the type int64
 here is i ..... TARGET_LOSS_AMT  ..... and here is the type float64
 here is i ..... LOAN  ..... and here is the type int64
 here is i ..... MORTDUE  ..... and here is the type float64
 here is i ..... VALUE  ..... and here is the type float64
 here is i ..... REASON  ..... and here is the type object
 here is i ..... JOB  ..... and here is the type object
 here is i ..... YOJ  ..... and here is the type float64
 here is i ..... DEROG  ..... and here is the type float64
 here is i ..... DELINQ  ..... and here is the type float64
 here is i ..... CLAGE  ..... and here is the type float64
 here is i ..... NINQ  ..... and here is the type float64
 here is i ..... CLNO  ..... and here is the type float64

 here is i ..... DEBTINC  ..... and here is the type float64
```

here is i ..... TARGET_BAD_FLAG ..... and here is the type int64
 here is i ..... TARGET_LOSS_AMT ..... and here is the type float64
 here is i ..... LOAN ..... and here is the type int64
 here is i ..... MORTDUE ..... and here is the type float64
 here is i ..... VALUE ..... and here is the type float64
 here is i ..... YOJ ..... and here is the type float64
 here is i ..... DEROG ..... and here is the type float64
 here is i ..... DELINQ ..... and here is the type float64
 here is i ..... CLAGE ..... and here is the type float64
 here is i ..... NINQ ..... and here is the type float64
 here is i ..... CLNO ..... and here is the type float64
 here is i ..... DEBTINC ..... and here is the type float64
 here is i ..... IMP_REASON ..... and here is the type object
 here is i ..... IMP_JOB ..... and here is the type object
MORTDUE
518
M_MORTDUE
IMP_MORTDUE
VALUE
112
M_VALUE
IMP_VALUE
YOJ
515
M_YOJ
IMP_YOJ
DEROG
708
M_DEROG
IMP_DEROG
DELINQ
580
M_DELINQ
IMP_DELINQ
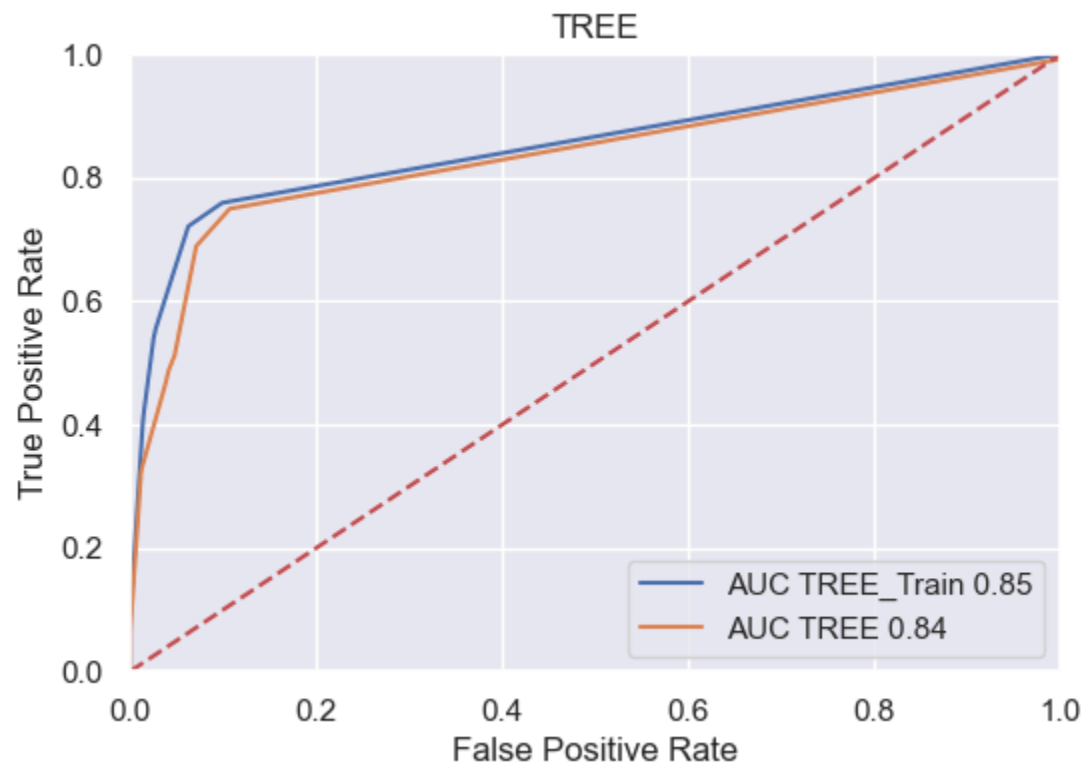CLAGE
308
M_CLAGE
IMP_CLAGE
NINQ
510
M_NINQ
IMP_NINQ
CLNO
222
M_CLNO
IMP_CLNO
DEBTINC
1267

M_DEBTINC
IMP_DEBTINC
[7]:


```
======
TREE_Train  =  0.8949244966442953
------



TREE  =  0.8791946308724832
------



TREE RMSE ACCURACY
======
TREE_Train  =  3209.472815354772
------



TREE  =  4060.582571899168
------
```
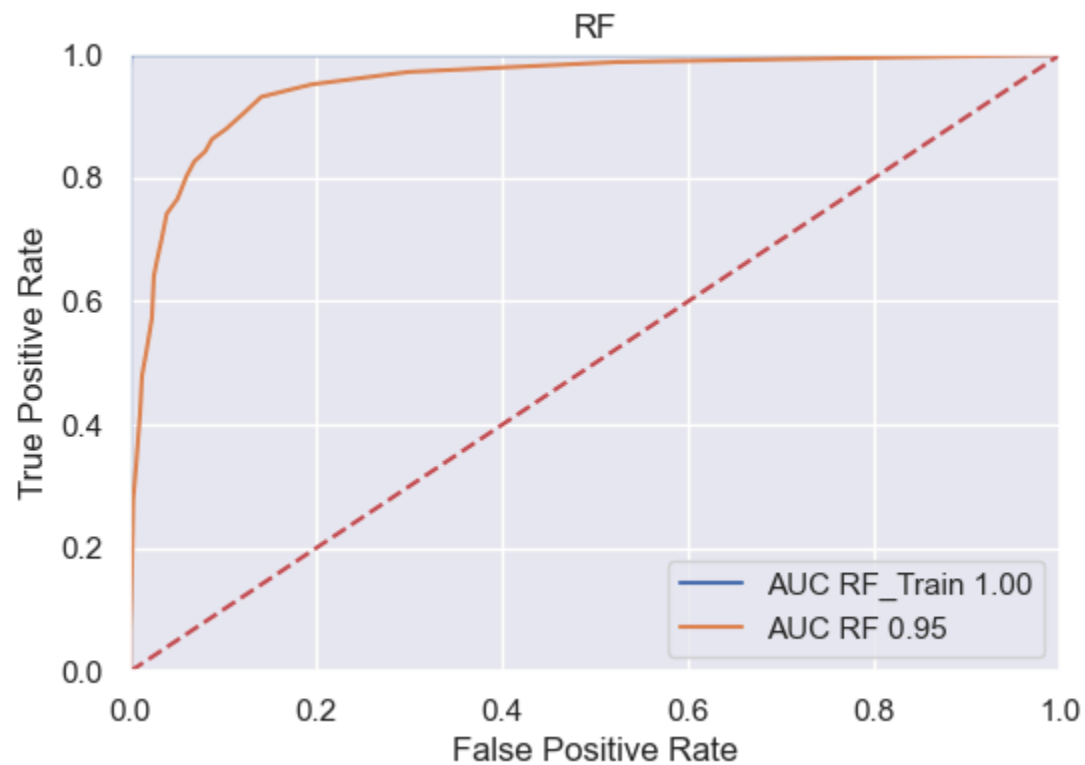
RF

```
RF CLASSIFICATION ACCURACY
======
RF_Train  =  0.9991610738255033
------


RF  =  0.9110738255033557
------


RF RMSE ACCURACY
======
RF_Train  =  838.404711691688
------


RF  =  2463.4168486405483
------


('IMP_JOB', 100)
('TRUNC_M_CLAGE', 13)
('TRUNC_M_NINQ', 7)
('TRUNC_IMP_CLAGE', 6)
```
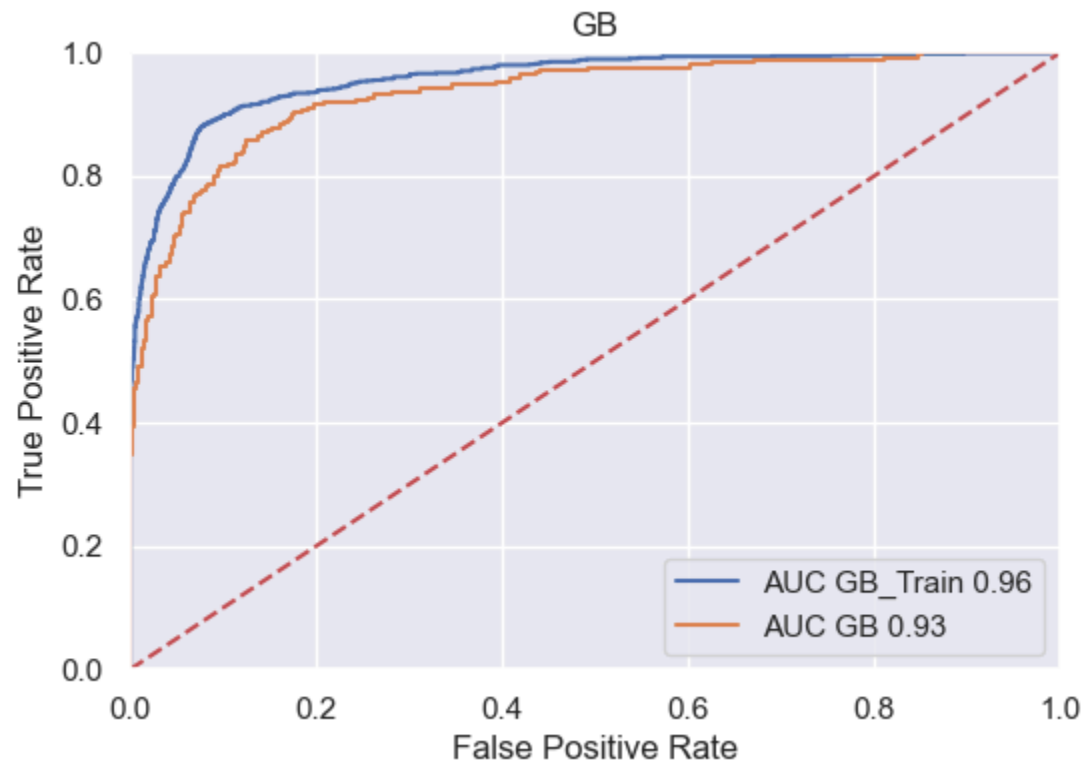
('TRUNC_M_DEROG', 4)

GB CLASSIFICATION ACCURACY
======
GB_Train = 0.9215604026845637

GB = 0.9001677852348994

GB RMSE ACCURACY
======
GB_Train = 1107.3885041339547

GB = 2293.6276799693437

('IMP_JOB', 100)
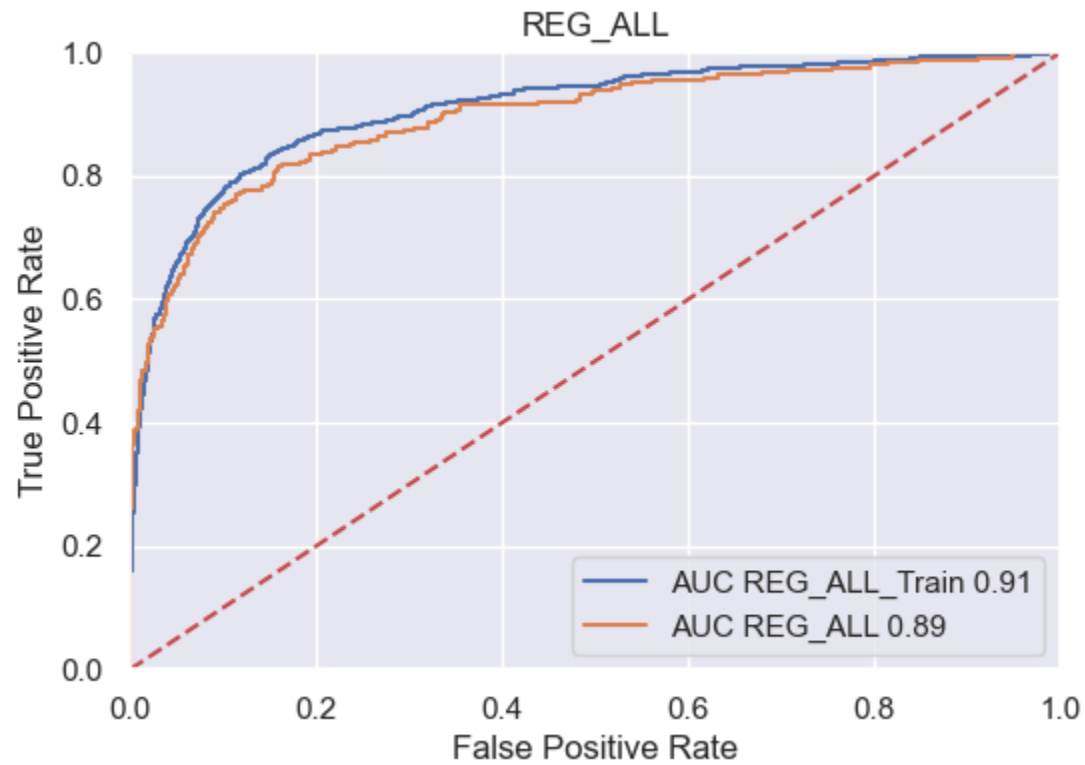('TRUNC_M_CLAGE', 13)
('TRUNC_M_NINQ', 7)
('TRUNC_IMP_CLAGE', 6)

('TRUNC_M_DEROG', 4)

REG_ALL CLASSIFICATION ACCURACY
======
REG_ALL_Train = 0.8924077181208053

REG_ALL = 0.8825503355704698

REG_ALL RMSE ACCURACY
======
REG_ALL_Train = 2957.4538316102658

REG_ALL = 3196.9824833559665

CRASH

Total Variables: 39

```
INTERCEPT  =  -4.510381307588504
O_LOAN  =  -0.09757075324013412
TRUNC_LOAN  =  -9.683334717755833e-06
O_M_MORTDUE  =  0.0
TRUNC_M_MORTDUE  =  0.373250037532751
O_IMP_MORTDUE  =  -0.26597296383582625
TRUNC_IMP_MORTDUE  =  -2.4342403704875285e-06
O_M_VALUE  =  3.337804477334435
TRUNC_M_VALUE  =  0.0
O_IMP_VALUE  =  1.2240770270761958
TRUNC_IMP_VALUE  =  5.109913302880779e-07
O_M_YOJ  =  0.0
TRUNC_M_YOJ  =  -0.604407443122348
O_IMP_YOJ  =  0.6596745004100119
TRUNC_IMP_YOJ  =  -0.01663290741340829
O_M_DEROG  =  0.0
TRUNC_M_DEROG  =  -1.7102354949879472
O_IMP_DEROG  =  0.42952376832925343
TRUNC_IMP_DEROG  =  0.5553620161719734
O_M_DELINQ  =  0.0
TRUNC_M_DELINQ  =  -0.142195568710771
O_IMP_DELINQ  =  1.9119510308511507
TRUNC_IMP_DELINQ  =  0.7158020580417312
O_M_CLAGE  =  0.0
TRUNC_M_CLAGE  =  0.9592146544079773
O_IMP_CLAGE  =  -0.8886494910032657
TRUNC_IMP_CLAGE  =  -0.006816981898993229
O_M_NINQ  =  0.0
TRUNC_M_NINQ  =  -0.1900667203395119
O_IMP_NINQ  =  -0.002547456323589395
TRUNC_IMP_NINQ  =  0.16216947285321504
O_M_CLNO  =  0.0
TRUNC_M_CLNO  =  1.800098493781746
O_IMP_CLNO  =  0.9186722980303212
TRUNC_IMP_CLNO  =  -0.00859523126813376
O_M_DEBTINC  =  0.0
TRUNC_M_DEBTINC  =  2.60567422260299
O_IMP_DEBTINC  =  2.5382966915620857
TRUNC_IMP_DEBTINC  =  0.09111022640455727


DAMAGES
---------
Total Variables:  39
INTERCEPT  =  -8949.415863751123
O_LOAN  =  -7106.900498966602
TRUNC_LOAN  =  0.5697568566725282
O_M_MORTDUE  =  5.4075029343181313e-08
TRUNC_M_MORTDUE  =  -1590.7867836054602
O_IMP_MORTDUE  =  -2883.587347006068
```
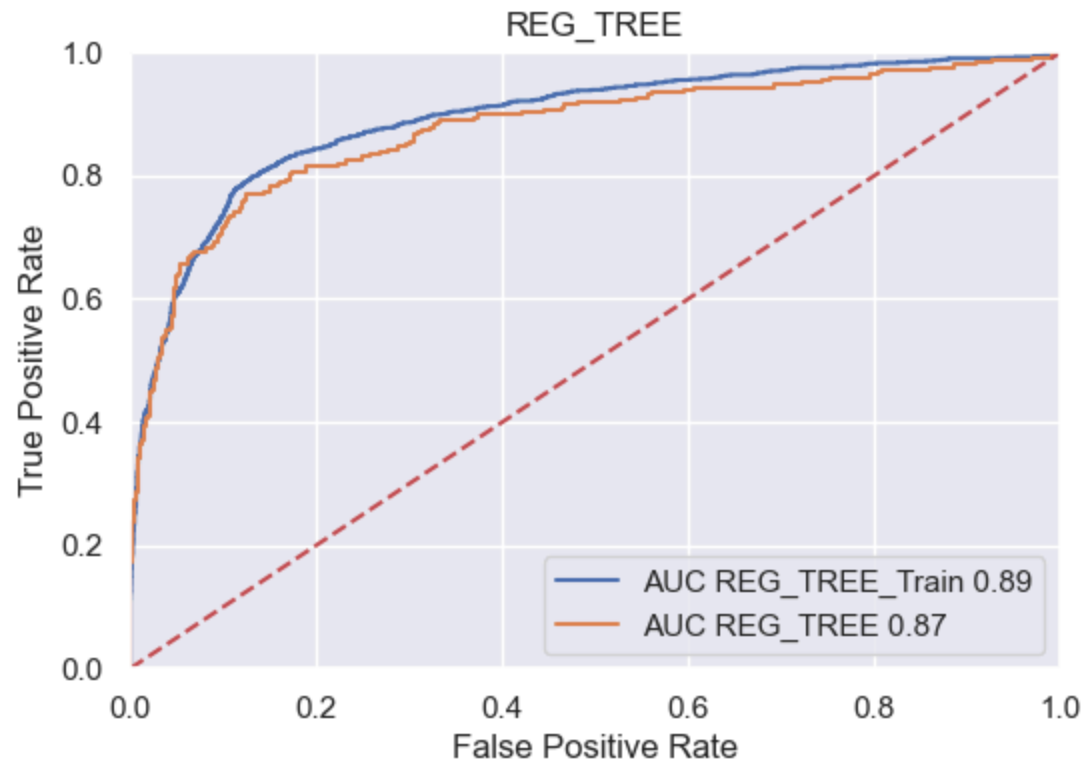
```
TRUNC_IMP_MORTDUE  =  0.012716796630595122
O_M_VALUE  =  440.92858571713856
TRUNC_M_VALUE  =  -7.844391802791506e-12
O_IMP_VALUE  =  -2146.8983178201684
TRUNC_IMP_VALUE  =  -0.005622152774414512
O_M_YOJ  =  -3.055333763768431e-12
TRUNC_M_YOJ  =  354.78135348160873
O_IMP_YOJ  =  1292.4370987675827
TRUNC_IMP_YOJ  =  -50.6639514654552
O_M_DEROG  =  4.547473508864641e-13
TRUNC_M_DEROG  =  695.8209048761961
O_IMP_DEROG  =  482.6681090359941
TRUNC_IMP_DEROG  =  429.5266003503066
O_M_DELINQ  =  -3.410605131648481e-13
TRUNC_M_DELINQ  =  1986.3090324287234
O_IMP_DELINQ  =  2148.3729806248293
TRUNC_IMP_DELINQ  =  629.1935069966383
O_M_CLAGE  =  -5.115907697472721e-13
TRUNC_M_CLAGE  =  -3792.1395486746023
O_IMP_CLAGE  =  -1.3642420526593924e-12
TRUNC_IMP_CLAGE  =  -20.62124374613167
O_M_NINQ  =  -9.094947017729282e-13
TRUNC_M_NINQ  =  -844.6391630031817
O_IMP_NINQ  =  1047.5046092555092
TRUNC_IMP_NINQ  =  -25.631374022013222
O_M_CLNO  =  0.0
TRUNC_M_CLNO  =  4152.675888489797
O_IMP_CLNO  =  -1506.1053489860615
TRUNC_IMP_CLNO  =  193.98235194288688
O_M_DEBTINC  =  0.0
TRUNC_M_DEBTINC  =  3942.7860177978346
O_IMP_DEBTINC  =  -1513.1273682788963
TRUNC_IMP_DEBTINC  =  204.63073968423322
```

REG_TREE

```
REG_TREE CLASSIFICATION ACCURACY
======
REG_TREE_Train  =  0.8823406040268457
------


REG_TREE  =  0.8825503355704698
------


REG_TREE RMSE ACCURACY
======
REG_TREE_Train  =  7474.912617376604
------


REG_TREE  =  7464.1215354916685
------



CRASH
---------
Total Variables:  12
INTERCEPT  =  -4.908660986775895
TRUNC_M_DEBTINC  =  2.7536331249543546
```

```
TRUNC_IMP_DEBTINC  =  0.10783727800216361
O_M_VALUE  =  3.7625611533410206
TRUNC_IMP_MORTDUE  =  -1.58066983743006e-06
TRUNC_IMP_VALUE  =  -7.843938613131137e-07
TRUNC_M_YOJ  =  -0.25133389956048546
TRUNC_IMP_YOJ  =  -0.019943179085577568
TRUNC_M_DEROG  =  -0.8467770310037397
O_IMP_DELINQ  =  1.9656643437134498
TRUNC_IMP_DELINQ  =  0.6736937769316723
TRUNC_IMP_CLAGE  =  -0.007273360899763904

DAMAGES
---------
Total Variables:  6
INTERCEPT  =  11576.486020790586
TRUNC_M_CLAGE  =  -6570.4950101747
TRUNC_IMP_CLAGE  =  6.27459049416989
TRUNC_M_NINQ  =  916.6108864381532
TRUNC_M_YOJ  =  -192.8785369438066
TRUNC_M_DEROG  =  2628.1176283538034




('TRUNC_IMP_CLAGE', 100)
('TRUNC_M_NINQ', 94)
('TRUNC_M_DEROG', 54)
('z_IMP_JOB_Self', 50)
('IMP_JOB', 44)
('TRUNC_M_YOJ', 43)
('z_IMP_JOB_Office', 43)
('TRUNC_M_CLAGE', 39)
('TRUNC_M_MORTDUE', 35)
('TRUNC_M_VALUE', 27)
('TRUNC_M_DELINQ', 21)




('IMP_JOB', 100)
('TRUNC_M_CLAGE', 13)
('TRUNC_M_NINQ', 7)
('TRUNC_IMP_CLAGE', 6)
('TRUNC_M_DEROG', 4)
```
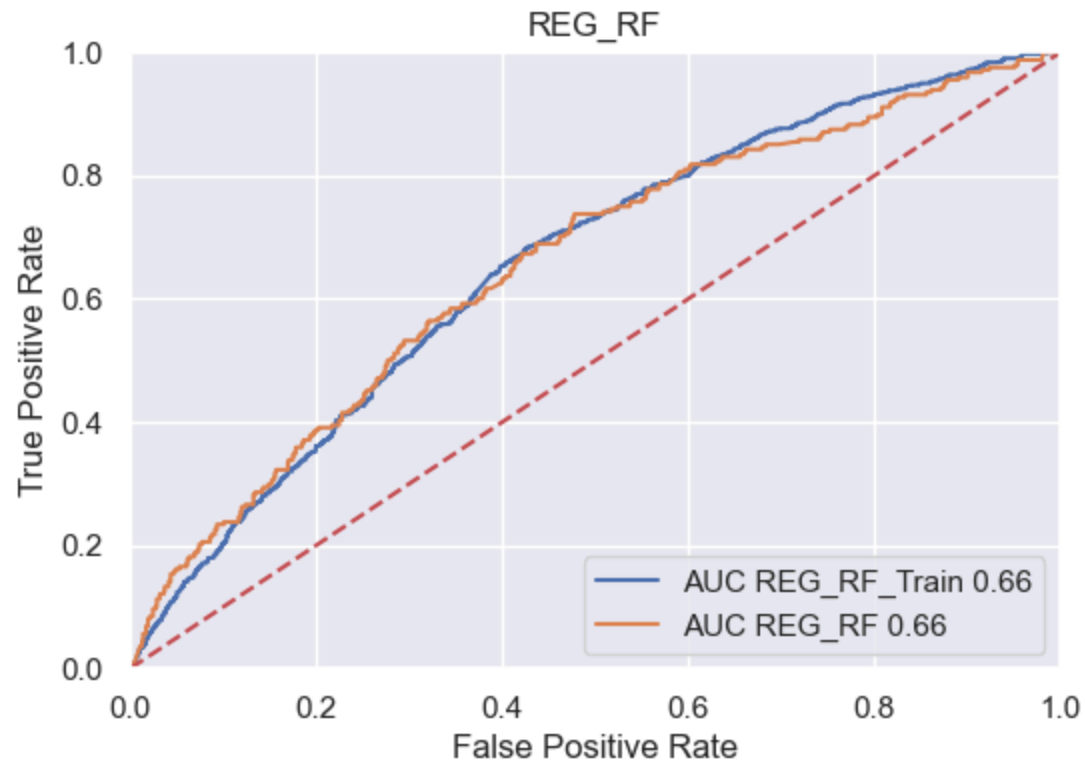
REG_RF

```
REG_RF CLASSIFICATION ACCURACY
======
REG_RF_Train  =  0.8026426174496645
------


REG_RF  =  0.7919463087248322
------


REG_RF RMSE ACCURACY
======
REG_RF_Train  =  7475.036020143663
------


REG_RF  =  7467.137170665965
------



CRASH
---------
Total Variables:  9
INTERCEPT  =  -0.2526556771458841
TRUNC_IMP_CLAGE  =  -0.006575047079858812
```

```
TRUNC_M_NINQ  =  -0.058216354297299745
TRUNC_M_DEROG  =  -0.4799956252581285
TRUNC_M_YOJ  =  -0.5280198483663112
TRUNC_M_CLAGE  =  1.1246645157132418
TRUNC_M_MORTDUE  =  0.23567715333600317
TRUNC_M_VALUE  =  0.0
TRUNC_M_DELINQ  =  -0.5522290950379439

DAMAGES
---------
Total Variables:  5
INTERCEPT  =  11568.97134485912
TRUNC_M_CLAGE  =  -6553.638321045655
TRUNC_M_NINQ  =  858.6705492898251
TRUNC_IMP_CLAGE  =  6.264552010144107
TRUNC_M_DEROG  =  2641.296412450692



('TRUNC_IMP_CLAGE', 100)
('TRUNC_M_NINQ', 28)
('TRUNC_M_DEROG', 17)
('TRUNC_M_YOJ', 17)
('z_IMP_JOB_Other', 7)
('TRUNC_M_VALUE', 6)
('IMP_JOB', 5)



('IMP_JOB', 100)
('TRUNC_M_CLAGE', 15)
('TRUNC_IMP_CLAGE', 7)
('TRUNC_M_NINQ', 6)
('TRUNC_M_DEROG', 5)
```
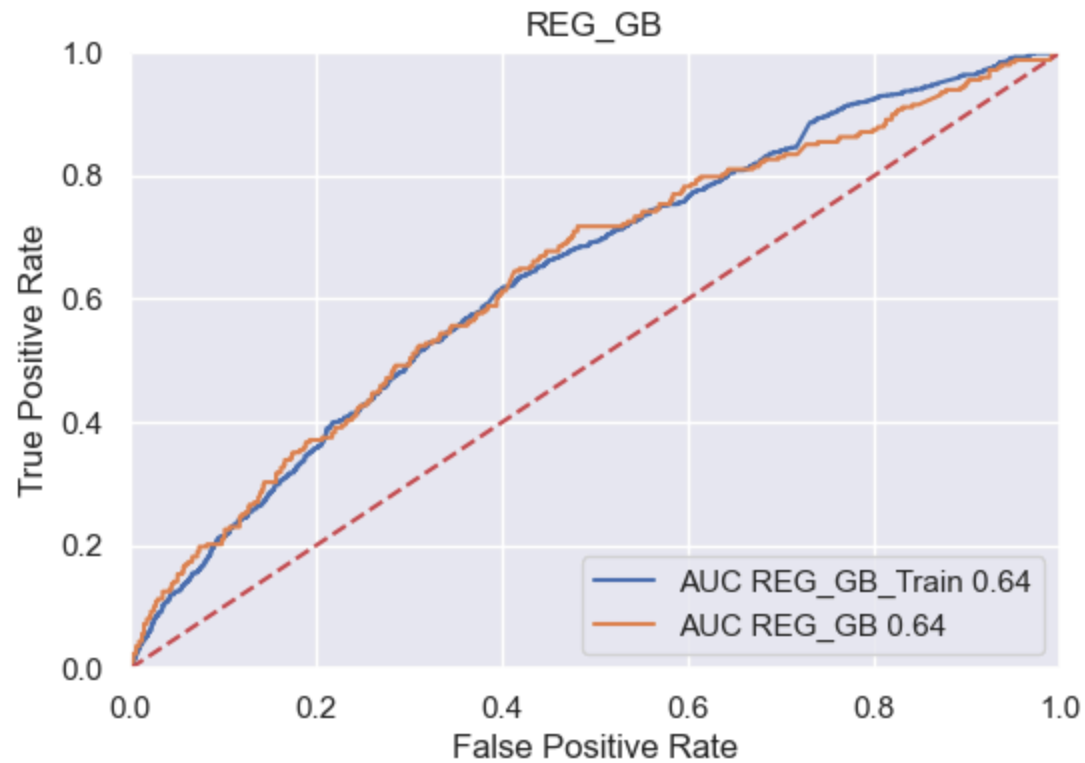
REG_GB

```
REG_GB CLASSIFICATION ACCURACY
======
REG_GB_Train  =  0.8026426174496645
------



REG_GB  =  0.7919463087248322
------



REG_GB RMSE ACCURACY
======
REG_GB_Train  =  7475.036020143663
------



REG_GB  =  7467.137170665965
------




CRASH
---------
Total Variables:  6
INTERCEPT  =  -0.26285234424615295
TRUNC_IMP_CLAGE  =  -0.006373827231844873
```

```
TRUNC_M_NINQ  =  0.04183204560307244
TRUNC_M_DEROG  =  -0.5069408457798064
TRUNC_M_YOJ  =  -0.36605361980257234
TRUNC_M_VALUE  =  0.0


DAMAGES
---------
Total Variables:  5
INTERCEPT  =  11568.97134485911
TRUNC_M_CLAGE  =  -6553.638321045659
TRUNC_IMP_CLAGE  =  6.264552010144165
TRUNC_M_NINQ  =  858.6705492898313
TRUNC_M_DEROG  =  2641.296412450695
```
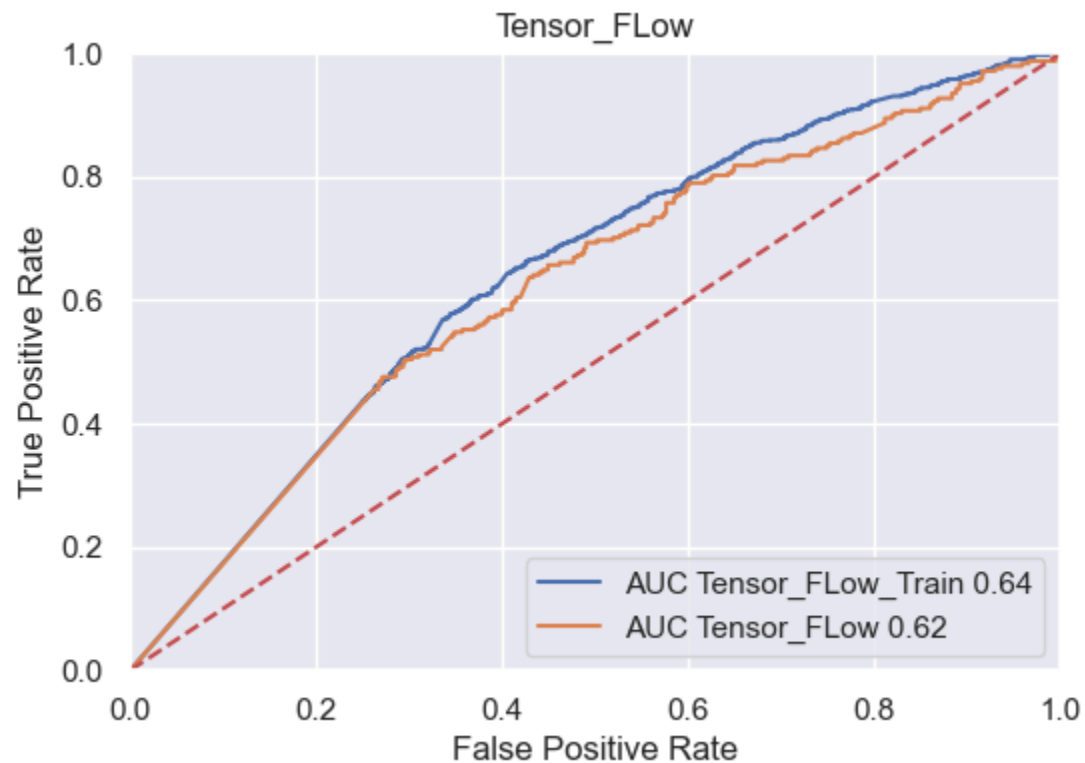
149/149 ━━━━━━━━━━━━━━━━━━━━━━━━━ **0s** 2ms/step
38/38 ━━━━━━━━━━━━━━━━━━━━━━━━━ **0s** 4ms/step


```
Tensor_FLow CLASSIFICATION ACCURACY
======
Tensor_FLow_Train  =  0.8026426174496645
------


Tensor_FLow  =  0.7919463087248322
------
```

30/30 ━━━━━━━━━━━━━━━━━━━━━━━━━━ **0s** 4ms/step
8/8 ━━━━━━━━━━━━━━━━━━━━━━━━━━━ **0s** 5ms/step

```
Tensor_FLow RMSE ACCURACY
======
Tensor_FLow_Train  =  7495.386771996012
------



Tensor_FLow  =  7470.434848783366
```


Tensor_FLow

ROC curve legend:
- AUC RF 0.95
- AUC GB 0.93
- AUC REG_ALL 0.89
- AUC REG_TREE 0.87
- AUC TREE 0.84
- AUC REG_RF 0.66
- AUC REG_GB 0.64
- AUC Tensor_FLow 0.62

X-axis: False Positive Rate
Y-axis: True Positive Rate

```
ALL CLASSIFICATION ACCURACY
======
RF  =  0.9110738255033557
------



GB  =  0.9001677852348994
------



REG_ALL  =  0.8825503355704698
------
```

```
REG_TREE  =  0.8825503355704698
------


TREE  =  0.8791946308724832
------


REG_RF  =  0.7919463087248322
------


REG_GB  =  0.7919463087248322
------


Tensor_FLow  =  0.7919463087248322
------


ALL DAMAGE MODEL ACCURACY
======
GB  =  2293.6276799693437
------


RF  =  2463.4168486405483
------


REG_ALL  =  3196.9824833559665
------


TREE  =  4060.582571899168
------


REG_TREE  =  7464.1215354916685
------


REG_RF  =  7467.137170665965
------


REG_GB  =  7467.137170665965
------
```

```
Tensor_FLow  =  7470.434848783366
------
```