

```
1 C:\Users\sriini\PycharmProjects\pythonProject\venv\  
  Scripts\python.exe C:\Users\sriini\PycharmProjects\  
  pythonProject\codes\lstm.py  
2 2024-05-06 13:41:06.581079: I tensorflow/core/util/  
  port.cc:113] oneDNN custom operations are on. You may  
  see slightly different numerical results due to  
  floating-point round-off errors from different  
  computation orders. To turn them off, set the  
  environment variable `TF_ENABLE_ONEDNN_OPTS=0`.  
3 2024-05-06 13:41:08.050750: I tensorflow/core/util/  
  port.cc:113] oneDNN custom operations are on. You may  
  see slightly different numerical results due to  
  floating-point round-off errors from different  
  computation orders. To turn them off, set the  
  environment variable `TF_ENABLE_ONEDNN_OPTS=0`.  
4 Class  
5 0      284315  
6 1      492  
7 Name: count, dtype: int64  
8 Normal share = 99.83  
9 Fraud share= 0.17  
10 C:\Users\sriini\PycharmProjects\pythonProject\codes\  
    lstm.py:30: UserWarning:  
11  
12 `distplot` is a deprecated function and will be  
  removed in seaborn v0.14.0.  
13  
14 Please adapt your code to use either `displot` (a  
  figure-level function with  
15 similar flexibility) or `kdeplot` (an axes-level  
  function for kernel density plots).  
16  
17 For a guide to updating your code to use the new  
  functions, please see  
18 https://gist.github.com/mwaskom/  
  de44147ed2974457ad6372750bbe5751  
19  
20 ax = sns.distplot(data_fraud['Amount'], label='  
  fraudulent', hist=False)  
21 C:\Users\sriini\PycharmProjects\pythonProject\codes\  
    lstm.py:31: UserWarning:
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30
31     ax = sns.distplot(data_non_fraud['Amount'], label='
   non fraudulent', hist=False)
32
33      Time      V1      V2 ...      V27
34      V28      Amount
35 201788  134039.0  2.023734 -0.429219 ... -0.000063 -
36 0.046947 -0.345273
37 179369  124044.0 -0.145286  0.736735 ... -0.006357
38 0.146053 -0.206439
39 73138   54997.0 -3.015846 -1.920606 ... -0.100726 -
40 0.365257  0.358043
41 208679  137226.0  1.851980 -1.007445 ... -0.094066 -
42 0.031488  0.362400
43 206534  136246.0  2.237844 -0.551513 ... -0.042838 -
44 0.063872 -0.316109
45
46 [5 rows x 30 columns]
47
48      Time      V1      V2 ...      V27
49      V28      Amount
50 49089   43906.0  1.229452 -0.235478 ...  0.060052
51 0.018104 -0.340485
52 154704  102638.0  2.016893 -0.088751 ... -0.048958 -
53 0.042831 -0.320859
54 67247   52429.0  0.535093 -1.469185 ... -0.083364
55 0.052485  0.853442
56 251657  155444.0  2.128486 -0.117215 ... -0.071733 -
57 0.072238 -0.344410
58 201903  134084.0  0.558593  1.587908 ...  0.168585

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45 0.004955 -0.229480
46
47 [5 rows x 30 columns]
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```

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707     sns.distplot(X_train[col])
708 Before sampling class distribution:- Counter({0:
    227449, 1: 396})
```

```

709 New class distribution:- Counter({0: 227449, 1:
227449})
710 (30, 1)
711 2024-05-06 13:42:22.761394: I tensorflow/core/
platform/cpu_feature_guard.cc:210] This TensorFlow
binary is optimized to use available CPU
instructions in performance-critical operations.
712 To enable the following instructions: AVX2 FMA, in
other operations, rebuild TensorFlow with the
appropriate compiler flags.
713 Model: "functional_1"
714
715 | Layer (type) | Param # | Output Shape
716 |
717 | input_layer (InputLayer) | 0 | (None, 30, 1)
718 |
719 | lstm (LSTM) | 16,896 | (None, 64)
720 |
721 | dropout (Dropout) | 0 | (None, 64)
722 |
723 | dense (Dense) | 65 | (None, 1)
724 |

725 Total params: 16,961 (66.25 KB)
726 Trainable params: 16,961 (66.25 KB)
727 Non-trainable params: 0 (0.00 B)
728 Epoch 1/100
729 11372/11373 ━━━━━━━━ 0s 11ms/step -
accuracy: 0.9549 - loss: 0.1399
730 Epoch 1: val_loss improved from inf to 0.03257,
saving model to ../models\Fraud_Detection_Model.

```

```
730 keras
731 11373/11373 ━━━━━━━━━━ 142s 12ms/step -
    accuracy: 0.9549 - loss: 0.1398 - val_accuracy: 0.
    9871 - val_loss: 0.0326
732 Epoch 2/100
733 11370/11373 ━━━━━━━━━━ 0s 10ms/step -
    accuracy: 0.9948 - loss: 0.0187
734 Epoch 2: val_loss improved from 0.03257 to 0.01247,
    saving model to ../models\Fraud_Detection_Model.
    keras
735 11373/11373 ━━━━━━━━━━ 133s 12ms/step -
    accuracy: 0.9948 - loss: 0.0187 - val_accuracy: 0.
    9922 - val_loss: 0.0125
736 Epoch 3/100
737 11368/11373 ━━━━━━━━━━ 0s 12ms/step -
    accuracy: 0.9974 - loss: 0.0105
738 Epoch 3: val_loss improved from 0.01247 to 0.00012,
    saving model to ../models\Fraud_Detection_Model.
    keras
739 11373/11373 ━━━━━━━━━━ 157s 14ms/step -
    accuracy: 0.9974 - loss: 0.0105 - val_accuracy: 1.
    0000 - val_loss: 1.1554e-04
740 Epoch 4/100
741 11372/11373 ━━━━━━━━━━ 0s 12ms/step -
    accuracy: 0.9984 - loss: 0.0080
742 Epoch 4: val_loss did not improve from 0.00012
743 11373/11373 ━━━━━━━━━━ 154s 14ms/step -
    accuracy: 0.9984 - loss: 0.0080 - val_accuracy: 1.
    0000 - val_loss: 1.2899e-04
744 Epoch 5/100
745 11373/11373 ━━━━━━━━━━ 0s 12ms/step -
    accuracy: 0.9988 - loss: 0.0059
746 Epoch 5: val_loss did not improve from 0.00012
747 11373/11373 ━━━━━━━━━━ 152s 13ms/step -
    accuracy: 0.9988 - loss: 0.0059 - val_accuracy: 0.
    9974 - val_loss: 0.0184
748 Epoch 6/100
749 11369/11373 ━━━━━━━━━━ 0s 12ms/step -
    accuracy: 0.9988 - loss: 0.0068
750 Epoch 6: val_loss improved from 0.00012 to 0.00003,
    saving model to ../models\Fraud_Detection_Model.
```

```
750 keras
751 11373/11373 ━━━━━━━━ 155s 14ms/step -
    accuracy: 0.9988 - loss: 0.0068 - val_accuracy: 1.
    0000 - val_loss: 2.9148e-05
752 Epoch 7/100
753 11370/11373 ━━━━━━━━ 0s 12ms/step -
    accuracy: 0.9992 - loss: 0.0041
754 Epoch 7: val_loss did not improve from 0.00003
755 11373/11373 ━━━━━━━━ 153s 13ms/step -
    accuracy: 0.9992 - loss: 0.0041 - val_accuracy: 1.
    0000 - val_loss: 1.3721e-04
756 Epoch 8/100
757 11371/11373 ━━━━━━━━ 0s 12ms/step -
    accuracy: 0.9992 - loss: 0.0041
758 Epoch 8: val_loss did not improve from 0.00003
759 11373/11373 ━━━━━━━━ 160s 14ms/step -
    accuracy: 0.9992 - loss: 0.0041 - val_accuracy: 1.
    0000 - val_loss: 6.1200e-05
760 Epoch 9/100
761 11370/11373 ━━━━━━━━ 0s 12ms/step -
    accuracy: 0.9993 - loss: 0.0042
762 Epoch 9: val_loss did not improve from 0.00003
763 11373/11373 ━━━━━━━━ 151s 13ms/step -
    accuracy: 0.9993 - loss: 0.0042 - val_accuracy: 1.
    0000 - val_loss: 8.0398e-05
764 Epoch 10/100
765 11369/11373 ━━━━━━━━ 0s 13ms/step -
    accuracy: 0.9994 - loss: 0.0031
766 Epoch 10: val_loss did not improve from 0.00003
767 11373/11373 ━━━━━━━━ 161s 14ms/step -
    accuracy: 0.9994 - loss: 0.0031 - val_accuracy: 1.
    0000 - val_loss: 4.7889e-05
768 Epoch 11/100
769 11370/11373 ━━━━━━━━ 0s 10ms/step -
    accuracy: 0.9995 - loss: 0.0033
770 Epoch 11: val_loss improved from 0.00003 to 0.00001
    , saving model to ../models\Fraud_Detection_Model.
    keras
771 11373/11373 ━━━━━━━━ 125s 11ms/step -
    accuracy: 0.9995 - loss: 0.0033 - val_accuracy: 1.
    0000 - val_loss: 1.1749e-05
```

```
772 Epoch 12/100
773 11372/11373 ━━━━━━━━ 0s 10ms/step -
    accuracy: 0.9995 - loss: 0.0030
774 Epoch 12: val_loss did not improve from 0.00001
775 11373/11373 ━━━━━━━━ 118s 10ms/step -
    accuracy: 0.9995 - loss: 0.0030 - val_accuracy: 0.
    9974 - val_loss: 0.0121
776 Epoch 13/100
777 11369/11373 ━━━━━━━━ 0s 9ms/step -
    accuracy: 0.9995 - loss: 0.0028
778 Epoch 13: val_loss improved from 0.00001 to 0.00000
    , saving model to ../models\Fraud_Detection_Model.
    keras
779 11373/11373 ━━━━━━━━ 117s 10ms/step -
    accuracy: 0.9995 - loss: 0.0028 - val_accuracy: 1.
    0000 - val_loss: 3.0937e-06
780 Epoch 14/100
781 11372/11373 ━━━━━━━━ 0s 10ms/step -
    accuracy: 0.9995 - loss: 0.0028
782 Epoch 14: val_loss did not improve from 0.00000
783 11373/11373 ━━━━━━━━ 121s 11ms/step -
    accuracy: 0.9995 - loss: 0.0028 - val_accuracy: 1.
    0000 - val_loss: 3.3080e-04
784 Epoch 15/100
785 11371/11373 ━━━━━━━━ 0s 9ms/step -
    accuracy: 0.9996 - loss: 0.0025
786 Epoch 15: val_loss did not improve from 0.00000
787 11373/11373 ━━━━━━━━ 112s 10ms/step -
    accuracy: 0.9996 - loss: 0.0025 - val_accuracy: 1.
    0000 - val_loss: 1.4412e-05
788 Epoch 16/100
789 11371/11373 ━━━━━━━━ 0s 9ms/step -
    accuracy: 0.9996 - loss: 0.0023
790 Epoch 16: val_loss did not improve from 0.00000
791 11373/11373 ━━━━━━━━ 116s 10ms/step -
    accuracy: 0.9996 - loss: 0.0023 - val_accuracy: 1.
    0000 - val_loss: 3.6250e-06
792 Epoch 17/100
793 11372/11373 ━━━━━━━━ 0s 10ms/step -
    accuracy: 0.9996 - loss: 0.0023
794 Epoch 17: val_loss did not improve from 0.00000
```

```
795 11373/11373 ━━━━━━━━ 123s 11ms/step -
    accuracy: 0.9996 - loss: 0.0023 - val_accuracy: 0.
    9950 - val_loss: 0.0253
796 Epoch 18/100
797 11373/11373 ━━━━━━━━ 0s 9ms/step -
    accuracy: 0.9996 - loss: 0.0027
798 Epoch 18: val_loss did not improve from 0.00000
799 11373/11373 ━━━━━━━━ 115s 10ms/step -
    accuracy: 0.9996 - loss: 0.0027 - val_accuracy: 1.
    0000 - val_loss: 6.3397e-05
800 Epoch 19/100
801 11370/11373 ━━━━━━━━ 0s 10ms/step -
    accuracy: 0.9997 - loss: 0.0016
802 Epoch 19: val_loss did not improve from 0.00000
803 11373/11373 ━━━━━━━━ 123s 11ms/step -
    accuracy: 0.9997 - loss: 0.0016 - val_accuracy: 1.
    0000 - val_loss: 8.2656e-06
804 Epoch 20/100
805 11371/11373 ━━━━━━━━ 0s 9ms/step -
    accuracy: 0.9997 - loss: 0.0019
806 Epoch 20: val_loss did not improve from 0.00000
807 11373/11373 ━━━━━━━━ 115s 10ms/step -
    accuracy: 0.9997 - loss: 0.0019 - val_accuracy: 0.
    9973 - val_loss: 0.0298
808 Epoch 21/100
809 11373/11373 ━━━━━━━━ 0s 10ms/step -
    accuracy: 0.9997 - loss: 0.0015
810 Epoch 21: val_loss did not improve from 0.00000
811 11373/11373 ━━━━━━━━ 122s 11ms/step -
    accuracy: 0.9997 - loss: 0.0015 - val_accuracy: 1.
    0000 - val_loss: 1.8266e-05
812 Epoch 22/100
813 11372/11373 ━━━━━━━━ 0s 9ms/step -
    accuracy: 0.9997 - loss: 0.0023
814 Epoch 22: val_loss did not improve from 0.00000
815 11373/11373 ━━━━━━━━ 111s 10ms/step -
    accuracy: 0.9997 - loss: 0.0023 - val_accuracy: 1.
    0000 - val_loss: 4.2152e-06
816 Epoch 23/100
817 11370/11373 ━━━━━━━━ 0s 9ms/step -
    accuracy: 0.9996 - loss: 0.0031
```

```
818 Epoch 23: val_loss did not improve from 0.00000
819 11373/11373 ━━━━━━━━ 117s 10ms/step -
    accuracy: 0.9996 - loss: 0.0031 - val_accuracy: 1.
    0000 - val_loss: 1.2753e-04
820 Epoch 23: early stopping
821 1781/1781 ━━━━━━━━ 8s 5ms/step -
    accuracy: 0.9987 - loss: 0.0124
822 7121/7121 ━━━━━━━━ 32s 4ms/step
823 Confusion Matrix:
824         Positive Negative
825
826 Positive 227383 (TP)      66 (FP)
827
828 Negative 0 (FN)     396 (TN)
829
830
831             precision    recall   f1-score
support
832
833          0       1.00      1.00      1.00
227449
834          1       0.86      1.00      0.92
396
835
836          accuracy           1.00
227845
837          macro avg      0.93      1.00      0.96
227845
838          weighted avg     1.00      1.00      1.00
227845
839
840 recall = tp/(tp+fn) : 1.0
841 precision = tp/(tp+fp) : 0.9997098250596838
842 sensitivity = tp/(tp+fn) : 1.0
843 accuracy = (tp+tn)/(negative + positive) : 99.
97103293905944
844 f1 score = (2*precision*recall)/(precision+recall)
) : 0.9998548914764133
845 1781/1781 ━━━━━━━━ 6s 3ms/step
846 Confusion Matrix:
847         Positive Negative
```

```
848
849 Positive 56820 (TP)      46 (FP)
850
851 Negative 24 (FN)      72 (TN)
852
853
854             precision    recall   f1-score
support
855
856         0       1.00     1.00     1.00
56866
857         1       0.61     0.75     0.67
96
858
859     accuracy           1.00
56962
860     macro avg       0.80     0.87     0.84
56962
861 weighted avg       1.00     1.00     1.00
56962
862
863 recall = tp/(tp+fn) :  0.9995777918513827
864 precision = tp/(tp+fp) :  0.9991910807864102
865 sensitivity = tp/(tp+fn) :  0.9995777918513827
866 accuracy = (tp+tn)/(negative + positive) :  99.
8771110564938
867 f1 score = (2*precision*recall)/(precision+recall)
) :  0.9993843989095067
868
869 Process finished with exit code 0
870
```