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" cursor: pointer;\n",

" display: none;\n",

" fill: #1967D2;\n",

" height: 32px;\n",

" padding: 0 0 0 0;\n",

" width: 32px;\n",

" }\n",

"\n",

" .colab-df-convert:hover {\n",

" background-color: #E2EBFA;\n",

" box-shadow: 0px 1px 2px rgba(60, 64, 67, 0.3), 0px 1px 3px 1px rgba(60, 64, 67, 0.15);\n",

" fill: #174EA6;\n",

" }\n",

"\n",

" [theme=dark] .colab-df-convert {\n",

" background-color: #3B4455;\n",

" fill: #D2E3FC;\n",

" }\n",

"\n",

" [theme=dark] .colab-df-convert:hover {\n",

" background-color: #434B5C;\n",

" box-shadow: 0px 1px 3px 1px rgba(0, 0, 0, 0.15);\n",

" filter: drop-shadow(0px 1px 2px rgba(0, 0, 0, 0.3));\n",

" fill: #FFFFFF;\n",

" }\n",

" </style>\n",

"\n",

" <script>\n",

" const buttonEl =\n",

" document.querySelector('#df-80209c26-0c42-4011-8023-8f80bc381df8 button.colab-df-convert');\n",

" buttonEl.style.display =\n",

" google.colab.kernel.accessAllowed ? 'block' : 'none';\n",

"\n",

" async function convertToInteractive(key) {\n",

" const element = document.querySelector('#df-80209c26-0c42-4011-8023-8f80bc381df8');\n",

" const dataTable =\n",

" await google.colab.kernel.invokeFunction('convertToInteractive',\n",

" [key], {});\n",

" if (!dataTable) return;\n",

"\n",

" const docLinkHtml = 'Like what you see? Visit the ' +\n",

" '<a target=\"\_blank\" href=https://colab.research.google.com/notebooks/data\_table.ipynb>data table notebook</a>'\n",

" + ' to learn more about interactive tables.';\n",

" element.innerHTML = '';\n",

" dataTable['output\_type'] = 'display\_data';\n",

" await google.colab.output.renderOutput(dataTable, element);\n",

" const docLink = document.createElement('div');\n",

" docLink.innerHTML = docLinkHtml;\n",

" element.appendChild(docLink);\n",

" }\n",

" </script>\n",

" </div>\n",

" </div>\n",

" "

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"categorical = pro.drop(columns=['CreditScore', 'Age', 'Tenure', 'Balance', 'EstimatedSalary'])\n",

"rows = int(np.ceil(categorical.shape[1] / 2)) - 1\n",

"\n",

"# create sub-plots anf title them\n",

"fig, axes = plt.subplots(nrows=rows, ncols=2, figsize=(10,6))\n",

"axes = axes.flatten()\n",

"\n",

"for row in range(rows):\n",

" cols = min(2, categorical.shape[1] - row\*2)\n",

" for col in range(cols):\n",

" col\_name = categorical.columns[2 \* row + col]\n",

" ax = axes[row\*2 + col] \n",

"\n",

" sns.countplot(data=categorical, x=col\_name, hue=\"Exited\", ax=ax);\n",

" \n",

"plt.tight\_layout()"

],

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"<Figure size 720x432 with 4 Axes>"

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"image/png": "\n"

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"outputId": "6b907ba3-bd99-488a-c175-d424babfc174"

},

"execution\_count": 23,

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"data": {

"text/plain": [

"<bound method DataFrame.info of CreditScore Geography Gender Age Tenure Balance NumOfProducts \\\n",

"0 619 France Female 42 2 0.00 1 \n",

"1 608 Spain Female 41 1 83807.86 1 \n",

"2 502 France Female 42 8 159660.80 3 \n",

"3 699 France Female 39 1 0.00 2 \n",

"4 850 Spain Female 43 2 125510.82 1 \n",

"... ... ... ... ... ... ... ... \n",

"9995 771 France Male 39 5 0.00 2 \n",

"9996 516 France Male 35 10 57369.61 1 \n",

"9997 709 France Female 36 7 0.00 1 \n",

"9998 772 Germany Male 42 3 75075.31 2 \n",

"9999 792 France Female 28 4 130142.79 1 \n",

"\n",

" HasCrCard IsActiveMember EstimatedSalary Exited \n",

"0 1 1 101348.88 1 \n",

"1 0 1 112542.58 0 \n",

"2 1 0 113931.57 1 \n",

"3 0 0 93826.63 0 \n",

"4 1 1 79084.10 0 \n",

"... ... ... ... ... \n",

"9995 1 0 96270.64 0 \n",

"9996 1 1 101699.77 0 \n",

"9997 0 1 42085.58 1 \n",

"9998 1 0 92888.52 1 \n",

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"[10000 rows x 11 columns]>"

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"metadata": {},

"execution\_count": 23

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"pro.isna().sum()"

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"outputId": "48d62ed5-01eb-4448-c688-4ce52dfc82c0"

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"data": {

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"Geography 0\n",

"Gender 0\n",

"Age 0\n",

"Tenure 0\n",

"Balance 0\n",

"NumOfProducts 0\n",

"HasCrCard 0\n",

"IsActiveMember 0\n",

"EstimatedSalary 0\n",

"Exited 0\n",

"dtype: int64"

]

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"metadata": {},

"execution\_count": 25

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]

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{

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"source": [

"for i in pro:\n",

" if pro[i].dtype=='object' or pro[i].dtype=='category':\n",

" print(\"unique of \"+i+\" is \"+str(len(set(df[i])))+\" they are \"+str(set(df[i])))"

],

"metadata": {

"colab": {

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},

"execution\_count": 26,

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"name": "stdout",

"text": [

"unique of Geography is 3 they are {'Germany', 'France', 'Spain'}\n",

"unique of Gender is 2 they are {'Male', 'Female'}\n",

"unique of HasCrCard is 2 they are {0, 1}\n",

"unique of IsActiveMember is 2 they are {0, 1}\n",

"unique of Exited is 2 they are {0, 1}\n"

]

}

]

},

{

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"source": [

"def box\_scatter(data, x, y): \n",

" fig, (ax1, ax2) = plt.subplots(nrows=2, ncols=1, figsize=(16,6))\n",

" sns.boxplot(data=data, x=x, ax=ax1)\n",

" sns.scatterplot(data=data, x=x,y=y,ax=ax2)"

],

"metadata": {

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"box\_scatter(pro,'CreditScore','Exited');\n",

"plt.tight\_layout()\n",

"print(f\"# of Bivariate Outliers: {len(pro.loc[pro['CreditScore'] < 400])}\")"

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"name": "stdout",

"text": [

"# of Bivariate Outliers: 19\n"

]

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"box\_scatter(pro,'Age','Exited');\n",

"plt.tight\_layout()\n",

"print(f\"# of Bivariate Outliers: {len(pro.loc[pro['Age'] > 87])}\")"

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"metadata": {

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"outputId": "f93eb05f-575e-4511-b09c-873a130eab33"

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]

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}

]

},

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"cell\_type": "code",

"source": [

"box\_scatter(pro,'Balance','Exited');\n",

"plt.tight\_layout()\n",

"print(f\"# of Bivariate Outliers: {len(pro.loc[pro['Balance'] > 220000])}\")"

],

"metadata": {

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{

"cell\_type": "code",

"source": [

"box\_scatter(pro,'EstimatedSalary','Exited');\n",

"plt.tight\_layout()"

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"id": "Pfob2xOV4G3o",

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{

"cell\_type": "code",

"source": [

"for i in pro:\n",

" if pro[i].dtype=='int64' or pro[i].dtypes=='float64':\n",

" q1=pro[i].quantile(0.25)\n",

" q3=pro[i].quantile(0.75)\n",

" iqr=q3-q1\n",

" upper=q3+1.5\*iqr\n",

" lower=q1-1.5\*iqr\n",

" pro[i]=np.where(pro[i] >upper, upper, pro[i])\n",

" pro[i]=np.where(pro[i] <lower, lower, pro[i])\n",

" "

],

"metadata": {

"id": "FLLla9bX4KuP"

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"box\_scatter(pro,'CreditScore','Exited');\n",

"plt.tight\_layout()\n",

"print(f\"# of Bivariate Outliers: {len(pro.loc[pro['CreditScore'] < 400])}\")"

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"box\_scatter(pro,'Age','Exited');\n",

"plt.tight\_layout()\n",

"print(f\"# of Bivariate Outliers: {len(pro.loc[pro['Age'] > 87])}\")"

],

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"box\_scatter(pro,'Balance','Exited');\n",

"plt.tight\_layout()\n",

"print(f\"# of Bivariate Outliers: {len(pro.loc[pro['Balance'] > 220000])}\")"

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"from sklearn.preprocessing import LabelEncoder\n",

"encoder=LabelEncoder()\n",

"for i in pro:\n",

" if pro[i].dtype=='object' or pro[i].dtype=='category':\n",

" pro[i]=encoder.fit\_transform(pro[i])"

],

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"x=pro.iloc[:,:-1]\n",

"x.head()"

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"execution\_count": 37,

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"1 608.0 2 0 41.0 1.0 83807.86 1.0 \n",

"2 502.0 0 0 42.0 8.0 159660.80 3.0 \n",

"3 699.0 0 0 39.0 1.0 0.00 2.0 \n",

"4 850.0 2 0 43.0 2.0 125510.82 1.0 \n",

"\n",

" HasCrCard IsActiveMember EstimatedSalary \n",

"0 1 1 101348.88 \n",

"1 0 1 112542.58 \n",

"2 1 0 113931.57 \n",

"3 0 0 93826.63 \n",

"4 1 1 79084.10 "

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" <div class=\"colab-df-container\">\n",

" <div>\n",

"<style scoped>\n",

" .dataframe tbody tr th:only-of-type {\n",

" vertical-align: middle;\n",

" }\n",

"\n",

" .dataframe tbody tr th {\n",

" vertical-align: top;\n",

" }\n",

"\n",

" .dataframe thead th {\n",

" text-align: right;\n",

" }\n",

"</style>\n",

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" <th>CreditScore</th>\n",

" <th>Geography</th>\n",

" <th>Gender</th>\n",

" <th>Age</th>\n",

" <th>Tenure</th>\n",

" <th>Balance</th>\n",

" <th>NumOfProducts</th>\n",

" <th>HasCrCard</th>\n",

" <th>IsActiveMember</th>\n",

" <th>EstimatedSalary</th>\n",

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" <td>1.0</td>\n",

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" <td>41.0</td>\n",

" <td>1.0</td>\n",

" <td>83807.86</td>\n",

" <td>1.0</td>\n",

" <td>0</td>\n",

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" <td>112542.58</td>\n",

" </tr>\n",

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" <td>1.0</td>\n",

" <td>0.00</td>\n",

" <td>2.0</td>\n",

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" <td>0</td>\n",

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" <td>2</td>\n",

" <td>0</td>\n",

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" <td>2.0</td>\n",

" <td>125510.82</td>\n",

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" <td>79084.10</td>\n",

" </tr>\n",

" </tbody>\n",

"</table>\n",

"</div>\n",

" <button class=\"colab-df-convert\" onclick=\"convertToInteractive('df-71330b13-2873-41c2-9dc0-b1458361a20d')\"\n",

" title=\"Convert this dataframe to an interactive table.\"\n",

" style=\"display:none;\">\n",

" \n",

" <svg xmlns=\"http://www.w3.org/2000/svg\" height=\"24px\"viewBox=\"0 0 24 24\"\n",

" width=\"24px\">\n",

" <path d=\"M0 0h24v24H0V0z\" fill=\"none\"/>\n",

" <path d=\"M18.56 5.44l.94 2.06.94-2.06 2.06-.94-2.06-.94-.94-2.06-.94 2.06-2.06.94zm-11 1L8.5 8.5l.94-2.06 2.06-.94-2.06-.94L8.5 2.5l-.94 2.06-2.06.94zm10 10l.94 2.06.94-2.06 2.06-.94-2.06-.94-.94-2.06-.94 2.06-2.06.94z\"/><path d=\"M17.41 7.96l-1.37-1.37c-.4-.4-.92-.59-1.43-.59-.52 0-1.04.2-1.43.59L10.3 9.45l-7.72 7.72c-.78.78-.78 2.05 0 2.83L4 21.41c.39.39.9.59 1.41.59.51 0 1.02-.2 1.41-.59l7.78-7.78 2.81-2.81c.8-.78.8-2.07 0-2.86zM5.41 20L4 18.59l7.72-7.72 1.47 1.35L5.41 20z\"/>\n",

" </svg>\n",

" </button>\n",

" \n",

" <style>\n",

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" display:flex;\n",

" flex-wrap:wrap;\n",

" gap: 12px;\n",

" }\n",

"\n",

" .colab-df-convert {\n",

" background-color: #E8F0FE;\n",

" border: none;\n",

" border-radius: 50%;\n",

" cursor: pointer;\n",

" display: none;\n",

" fill: #1967D2;\n",

" height: 32px;\n",

" padding: 0 0 0 0;\n",

" width: 32px;\n",

" }\n",

"\n",

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" box-shadow: 0px 1px 2px rgba(60, 64, 67, 0.3), 0px 1px 3px 1px rgba(60, 64, 67, 0.15);\n",

" fill: #174EA6;\n",

" }\n",

"\n",

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" fill: #D2E3FC;\n",

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"\n",

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" box-shadow: 0px 1px 3px 1px rgba(0, 0, 0, 0.15);\n",

" filter: drop-shadow(0px 1px 2px rgba(0, 0, 0, 0.3));\n",

" fill: #FFFFFF;\n",

" }\n",

" </style>\n",

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" <script>\n",

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" document.querySelector('#df-71330b13-2873-41c2-9dc0-b1458361a20d button.colab-df-convert');\n",

" buttonEl.style.display =\n",

" google.colab.kernel.accessAllowed ? 'block' : 'none';\n",

"\n",

" async function convertToInteractive(key) {\n",

" const element = document.querySelector('#df-71330b13-2873-41c2-9dc0-b1458361a20d');\n",

" const dataTable =\n",

" await google.colab.kernel.invokeFunction('convertToInteractive',\n",

" [key], {});\n",

" if (!dataTable) return;\n",

"\n",

" const docLinkHtml = 'Like what you see? Visit the ' +\n",

" '<a target=\"\_blank\" href=https://colab.research.google.com/notebooks/data\_table.ipynb>data table notebook</a>'\n",

" + ' to learn more about interactive tables.';\n",

" element.innerHTML = '';\n",

" dataTable['output\_type'] = 'display\_data';\n",

" await google.colab.output.renderOutput(dataTable, element);\n",

" const docLink = document.createElement('div');\n",

" docLink.innerHTML = docLinkHtml;\n",

" element.appendChild(docLink);\n",

" }\n",

" </script>\n",

" </div>\n",

" </div>\n",

" "

]

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"metadata": {},

"execution\_count": 37

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"y=pro.iloc[:,-1]\n",

"y.head()"

],

"metadata": {

"colab": {

"base\_uri": "https://localhost:8080/"

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"id": "rkOlvrHU4vLo",

"outputId": "5193081f-f0d5-417a-9b6e-6d3951706315"

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"data": {

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"0 1\n",

"1 0\n",

"2 1\n",

"3 0\n",

"4 0\n",

"Name: Exited, dtype: int64"

]

},

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"execution\_count": 38

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"from sklearn.preprocessing import StandardScaler\n",

"scaler=StandardScaler()\n",

"x=scaler.fit\_transform(x)"

],

"metadata": {

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" 0.97024255, 0.02188649],\n",

" [-0.44080365, 1.51506738, -1.09598752, ..., -1.54776799,\n",

" 0.97024255, 0.21653375],\n",

" [-1.53863634, -0.90188624, -1.09598752, ..., 0.64609167,\n",

" -1.03067011, 0.2406869 ],\n",

" ...,\n",

" [ 0.60524449, -0.90188624, -1.09598752, ..., -1.54776799,\n",

" 0.97024255, -1.00864308],\n",

" [ 1.25772996, 0.30659057, 0.91241915, ..., 0.64609167,\n",

" -1.03067011, -0.12523071],\n",

" [ 1.4648682 , -0.90188624, -1.09598752, ..., 0.64609167,\n",

" -1.03067011, -1.07636976]])"

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"from sklearn.model\_selection import train\_test\_split\n",

"x\_train,x\_test,y\_train,y\_test=train\_test\_split(x,y,test\_size=0.33)\n",

"x\_train.shape"

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"(6700, 10)"

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"data": {

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"metadata": {

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