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LAMPIRAN

Lampiran 1. Dataset Daftar Rasio Keuangan Perusahaan Perbankan di Indonesia Tahun 2013 - 2022

Nama_Bank	Tahun	CAR	ROA	ROE	LDR	BOPO	NIM	NPL	FD
Mandiri	2013	14.93	3.66	27.31	82.97	62.41	5.68	1.6	0
BRI	2013	16.99	5.03	34.11	88.54	60.58	8.55	1.55	0
BCA	2013	15.7	3.8	28.2	75.4	61.5	6.2	0.4	0
Sinarmas	2013	21.82	1.71	9.23	78.72	88.5	5.23	2.5	0
Mestika	2013	26.99	5.42	17.98	102.35	54.13	8.36	2.16	0
OCBC NISP	2013	19.28	1.81	11.87	92.49	78.03	4.11	0.73	0
BTN	2013	15.62	1.79	16.05	104.42	82.19	5.44	4.05	0
Jago	2013	21.62	0.58	2.19	109.08	94.69	6.75	1.07	0
QnB Indonesia	2013	18.74	0.09	0.4	113.3	100.57	2.82	0.23	1
BNI	2013	15.2	3.4	22.5	85.3	67.1	6.1	2.2	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Bumi Artha	2022	59.27	0.59	1.69	77.34	91.31	4.62	4.56	0
CCB	2022	35.57	0.69	2.4	92.98	87.76	3.54	3.4	0
Panin Dubai	2022	22.71	1.79	11.51	97.32	76.99	6.91	3.31	0
Artha Graha	2022	23.82	0.25	1.63	82.89	96.26	4.79	2.73	1
Amar	2022	82.52	-4.75	-8.4	220.31	119.36	15.87	6.09	1
OKE	2022	47.67	0.22	0.41	146.06	97.28	5.68	2.75	1
INA	2022	31.13	1.09	6.57	1.73	82.43	3.49	1.73	0
National Nobu	2022	18.54	0.64	6.39	82.52	75.35	3.35	0.41	0
JTrust	2022	14.86	0.17	3.5	76.11	99.04	2.77	1.8	1
MAS	2022	28.52	1.86	10.84	50.47	69.6	3.91	3.09	0

Lampiran 2. *Syntax* Program *Python* Klasifikasi *Financial distress* Menggunakan XGBoost dan ANN

Import *Library* yang Dibutuhkan

```
from google.colab import drive
import pandas as pd
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from jcopml.plot import plot_correlation_matrix
import matplotlib.pyplot as plt
import seaborn as sns
from xgboost import XGBClassifier
from sklearn.metrics import accuracy_score,
classification_report
from sklearn.metrics import
accuracy_score,recall_score,f1_score,precision_score,
roc_auc_score,confusion_matrix,precision_score
from torch.utils.data import Dataset, DataLoader
import torch
```

Preprocessing Data

```
# mengimpor dataset dari lokal drive
from google.colab import drive
drive.mount('/content/gdrive', force_remount=True)

# menampilkan dataset 5 data teratas
import pandas as pd
df = pd.read_excel("Financial distress Data.xlsx")
df.head()

# menampilkan informasi dataset
df.info()

# menghapus kolom yang tidak perlu
p(['Unnamed: 10','Unnamed: 11'], axis=1, inplace=True)

 pandas as pd
klearn.preprocessing import StandardScaler
```

```
# Kolom yang akan dikecualikan dari normalisasi
columns_to_exclude = ['Financial distress', 'Nama_Bank']

# Menduplikat dataframe
normalized_data = df.copy()

# Inisialisasi objek scaler
scaler = StandardScaler()

# Melakukan normalisasi pada kolom yang tidak dikecualikan
columns_to_normalize = [col for col in df.columns if col not
in columns_to_exclude]
normalized_data[columns_to_normalize] =
scaler.fit_transform(df[columns_to_normalize])
```

Metode *Extreme gradient Boosting*

```
# membagi data x dan y kemudian melakukan train test split
X = data.drop(['Financial distress', 'Nama_Bank', 'Tahun'],
axis=1)
y = data['Financial distress']

X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.25, stratify=y, random_state=42)
X_train.shape, X_test.shape, y_train.shape, y_test.shape

# melakukan pelatihan model
xgb_model = XGBClassifier(learning_rate=0.1,
n_estimators=100, random_state=42)
xgb_model.fit(X_train, y_train)

# menampilkan akurasi dan mengebaluasi model xgboost
y_pred_xgb = xgb_model.predict(X_test)
print("\nXGBoost Model:")
accuracy_xgb_smote = round(accuracy_score(y_test,
y_pred_xgb),3)
print("Accuracy:",accuracy_xgb_smote)
print("Classification Report:")
print(classification_report(y_test, y_pred_xgb))
```

```
# menampilkan confusion matrix
cm = confusion_matrix(y_test, y_pred_xgb)
plt.figure(figsize=(8, 6))
sns.heatmap(cm, annot=True, fmt="d", cmap="Blues")
plt.title('Confusion matrix')
plt.xlabel('True')
plt.ylabel('Predict')
plt.show()
```

Metode *Artificial Neural Network*

```
# membagi data x dan y
x = df.drop(['Nama_Bank', 'Tahun', 'Financial distress'],
axis=1)
y = df['Financial distress'].values

# mengubah data x menjadi array dan melakukan standar scaler
scaler = StandardScaler()
1
x = scaler.fit_transform(x)

# melakukan train test split
X_train, X_test, y_train, y_test = train_test_split(x, y,
test_size=0.25, stratify=y, random_state=40)
X_train.shape, X_test.shape, y_train.shape, y_test.shape

# membuat class Tabular Data
class TabularData(Dataset):
  def __init__ (self, x, y):
    super(). __init__()
    self.x = torch.from_numpy(x).type(torch.float32)
    self.y = torch.from_numpy(y).type(torch.float32)

  def __len__(self):
    return len(self.x)

  def __getitem__(self, id):
    return self.x[id], self.y[id]
```

```
# membuat kelas binclr
class Binclr(torch.nn.Module):
  def __init__ (self):
    super().__init__()

    self.layer1 = torch.nn.Linear(in_features=7,
out_features=32)
    self.layer2 = torch.nn.Linear(in_features=32,
out_features=16)
    self.layer3 = torch.nn.Linear(in_features=16,
out_features=1)
    self.relu = torch.nn.ReLU()

  def forward(self, x:torch.Tensor):
    return
self.layer3(self.relu(self.layer2(self.relu(self.layer1(x)))))

# menginisialisasi peragkat dan membuat objek model
device = 'cuda' if torch.cuda.is_available() else 'cpu'
model = Binclr().to(device)

# menentukan fungsi loss dan optimizer
loss = torch.nn.BCELoss()
optim = torch.optim.Adam(params=model.parameters(), lr=0.001)

# melakukan training model
epochs = 30

for epoch in range(epochs):
  temp_loss = []
  for i, (features, target) in enumerate(train_loader):
    model.train()

    y_pred = model(features)

    y_pred = torch.sigmoid(y_pred)

    loss_fn = loss(y_pred.squeeze(), target)

    mp_loss.append(loss_fn.item())

    tim.zero_grad()
```

```
    loss_fn.backward()

    optim.step()

  print(f"epoch {epoch} | loss:
{sum(temp_loss)/len(temp_loss)}")

# melakukan prediksi pada data testing
y_pred =
torch.sigmoid(model(torch.from_numpy(X_test).to(torch.float32
))).detach().numpy()

# melakukan evaluasi model
print("\nXGBoost Model:")
accuracy_ANN = round(accuracy_score(y_test, y_pred),3)
print("Accuracy:",accuracy_ANN)
print("Classification Report:")
print(classification_report(y_test, y_pred))

# menampilkan confusion matrix
cm = confusion_matrix(y_test, y_pred)

plt.figure(figsize=(8, 6))
sns.heatmap(cm, annot=True, fmt="d", cmap="Blues")
plt.title('Confusion matrix')
plt.xlabel('True')
plt.ylabel('Predict')
plt.show()
```

Membandingkan Metode XGBoost dan ANN

```
model_comp1 = pd.DataFrame({'Model': ['XGBoost','ANN'],
'Accuracy': [accuracy_xgb_smote*100, accuracy_ANN*100]})

# Membuat bar plot dengan keterangan jumlah
fig, ax = plt.subplots()
bars = plt.bar(model_comp1['Model'], model_comp1['Accuracy'],
color=['red', 'green', 'blue'])
abel('Model')
abel('Accuracy (%)')
tle('Perbandingan Model XGBoost dan ANN')
icks(rotation=45, ha='right')  # Untuk memutar label
x agar lebih mudah dibaca
```

```
# Menambahkan keterangan jumlah di atas setiap bar
for bar in bars:
    yval = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, yval,
round(yval, 2), ha='center', va='bottom')
```