Cryptocurrency Liquidity Prediction for Market Stability

In [7]:
```
import pandas as pd


df1 = pd.read_csv('day1.csv')
df2 = pd.read_csv('day2.csv')
```

In [8]:
```
df = pd.concat([df1, df2], ignore_index=True)


print(df.shape)
```

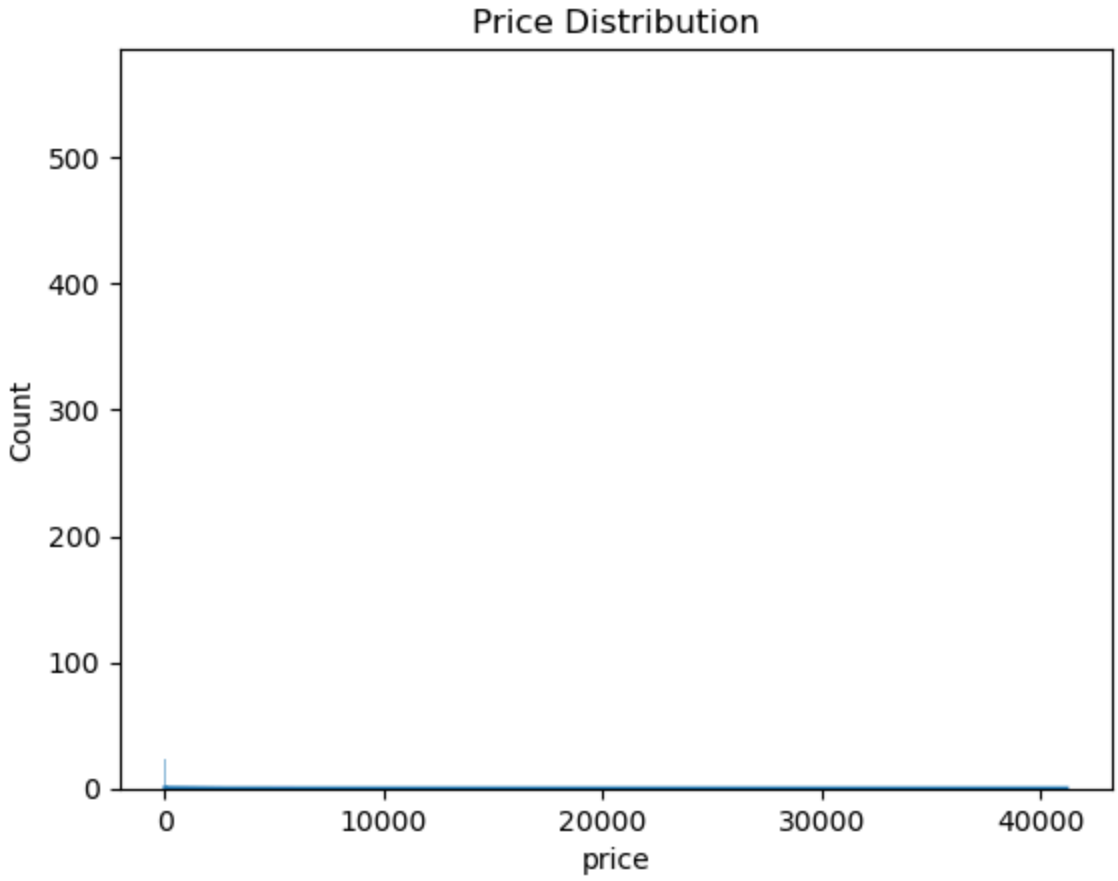
```
(1000, 9)
```

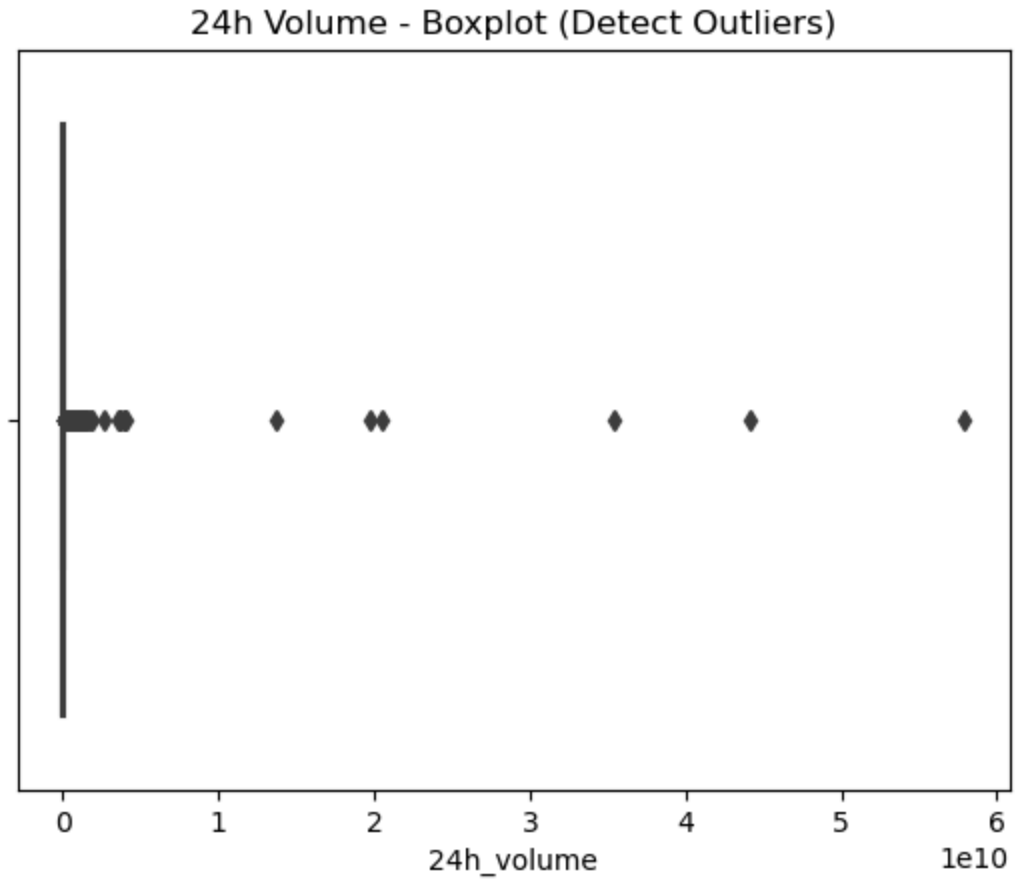
In [10]:
```
#Clean the Combined Data

df['date'] = pd.to_datetime(df['date'])


df.drop_duplicates(inplace=True)


df.fillna(df.median(numeric_only=True), inplace=True)


df.sort_values(by=['symbol', 'date'], inplace=True)
```

In [13]:
```
#Add Liquidity Features

df['liquidity_ratio'] = df['24h_volume'] / df['mkt_cap']
```

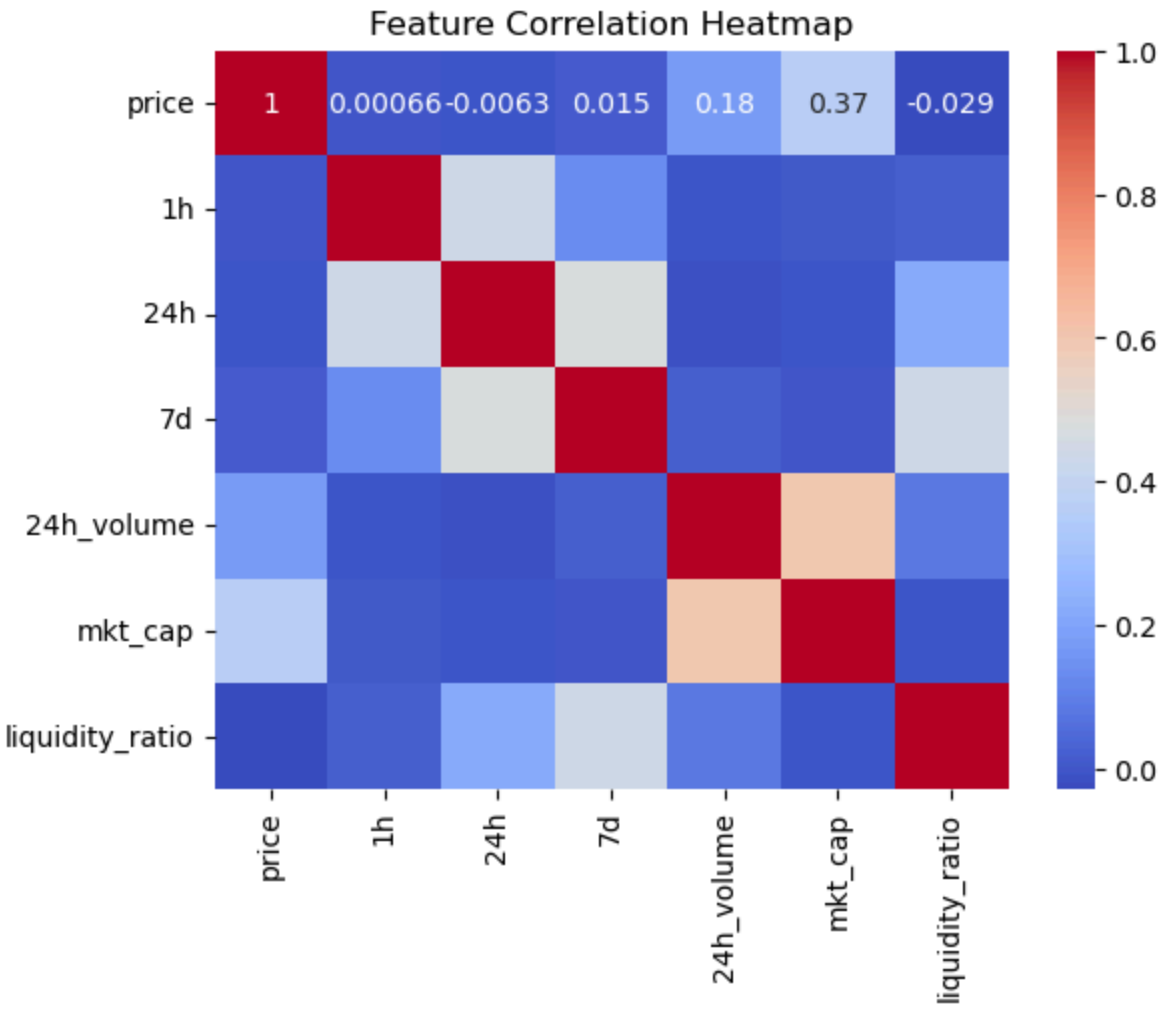
In [19]:
```
#EDA

import seaborn as sns
import matplotlib.pyplot as plt

sns.histplot(df['price'], kde=True)
plt.title('Price Distribution')
plt.show()

sns.boxplot(x=df['24h_volume'])
plt.title('24h Volume - Boxplot (Detect Outliers)')
plt.show()
```

```
/opt/conda/envs/anaconda-ai-2024.04-py310/lib/python3.10/site-packages/seaborn/_oldc
ore.py:1119: FutureWarning: use_inf_as_na option is deprecated and will be removed i
n a future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
```

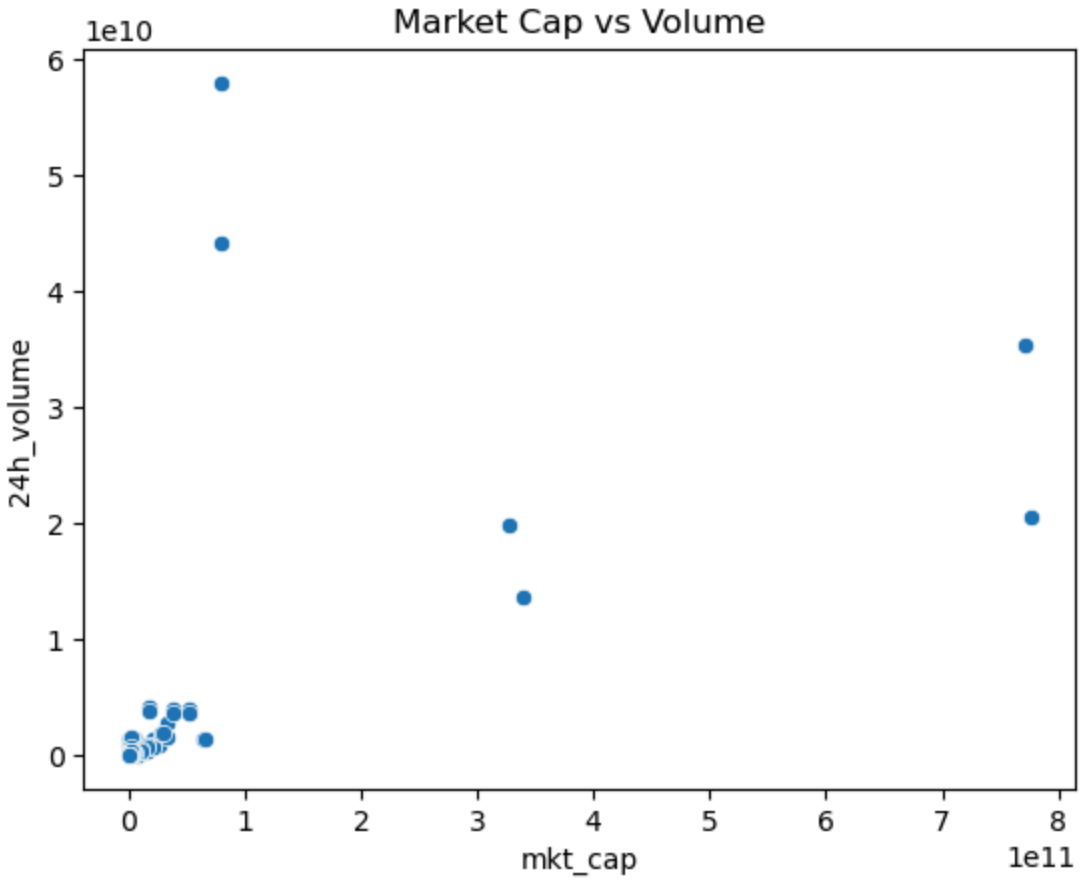

Price Distribution
Count
500
400
300
200
100
0
0
10000
20000
30000
40000
price


24h Volume - Boxplot (Detect Outliers)
0
1
2
3
4
5
6
24h_volume
1e10

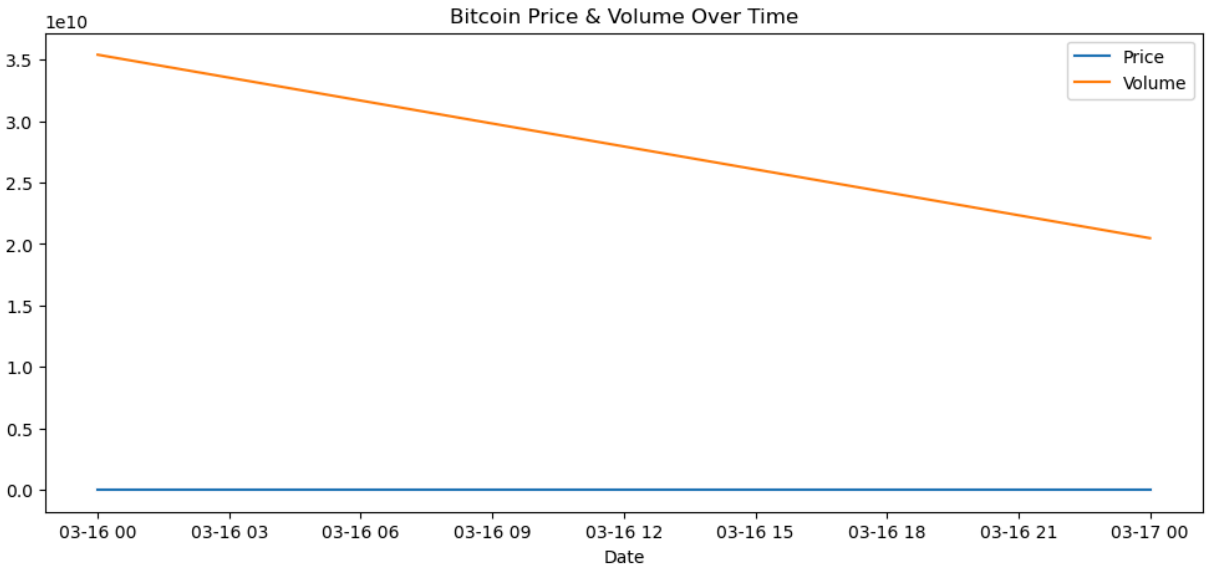
In [20]:
```
corr = df[['price', '1h', '24h', '7d', '24h_volume', 'mkt_cap', 'liquidity_ratio']]
sns.heatmap(corr, annot=True, cmap='coolwarm')
plt.title("Feature Correlation Heatmap")
plt.show()
```



In [21]:
```
sns.scatterplot(x='mkt_cap', y='24h_volume', data=df)
plt.title('Market Cap vs Volume')
plt.show()
```



In [22]:
```
# Model Selection(time series)
btc = df[df['symbol'] == 'BTC']

plt.figure(figsize=(12, 5))
plt.plot(btc['date'], btc['price'], label='Price')
plt.plot(btc['date'], btc['24h_volume'], label='Volume')
plt.title("Bitcoin Price & Volume Over Time")
plt.xlabel("Date")
plt.legend()
plt.show()
```



In [23]:
```
df.groupby('symbol')['24h_volume'].mean().sort_values(ascending=False).head(10)
```

Out[23]:
```
symbol
USDT    5.103319e+10
BTC     2.793344e+10
ETH     1.669455e+10
BUSD    3.876542e+09
XRP     3.784076e+09
USDC    3.721045e+09
LUNA    2.108436e+09
SOL     1.849078e+09
BNB     1.410604e+09
FLEX    1.323654e+09
Name: 24h_volume, dtype: float64
```

In [24]:
```
#Feature Engineering


df.sort_values(by=['symbol', 'date'], inplace=True)

# Daily price and volume change (absolute)
df['price_change'] = df.groupby('symbol')['price'].diff()
df['volume_change'] = df.groupby('symbol')['24h_volume'].diff()

# Daily % change (relative)
df['price_pct_change'] = df.groupby('symbol')['price'].pct_change()
df['volume_pct_change'] = df.groupby('symbol')['24h_volume'].pct_change()
```

In [27]:
```
df['price_ma_3'] = df.groupby('symbol')['price'].rolling(window=3).mean().reset_ind
df['volume_ma_3'] = df.groupby('symbol')['24h_volume'].rolling(window=3).mean().res


df['price_volatility'] = df.groupby('symbol')['price'].rolling(window=3).std().rese
```

In [28]:
```
df['price_lag1'] = df.groupby('symbol')['price'].shift(1)
df['volume_lag1'] = df.groupby('symbol')['24h_volume'].shift(1)
```

In [30]:
```
df['day'] = df['date'].dt.day
df['month'] = df['date'].dt.month
df['weekday'] = df['date'].dt.weekday
```

In [32]:
```
print(X.isnull().sum())
```

```
price              0
1h                 0
24h                0
7d                 0
mkt_cap            0
volume_change    503
price_ma_3       994
dtype: int64
```

In [33]:
```
# Fill with median (recommended for financial data)
X = X.fillna(X.median(numeric_only=True))
```

In [34]:
```
#Model Training

from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor
from sklearn.impute import SimpleImputer
from sklearn.metrics import mean_squared_error, r2_score
import numpy as np


X = df[features]
y = df[target]


X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, shuffle=Fa


imputer = SimpleImputer(strategy='median')
X_train = imputer.fit_transform(X_train)
X_test = imputer.transform(X_test)


model = RandomForestRegressor()
model.fit(X_train, y_train)


y_pred = model.predict(X_test)
print("RMSE:", np.sqrt(mean_squared_error(y_test, y_pred)))
print("R²:", r2_score(y_test, y_pred))
```

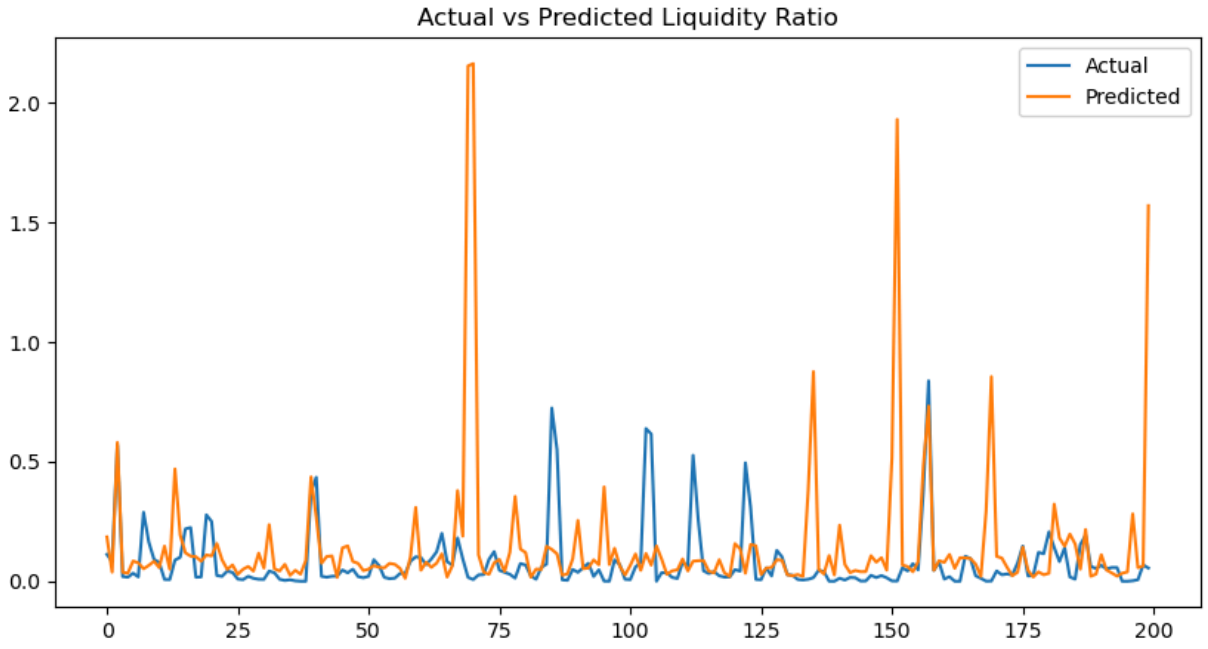
```
RMSE: 0.3183408705323683
R²: -4.743045097443412
```

In [35]:
```
#Model Evaluation

from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
import numpy as np


y_pred = model.predict(X_test)


mae = mean_absolute_error(y_test, y_pred)
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
r2 = r2_score(y_test, y_pred)

print(f"MAE: {mae}")
print(f"RMSE: {rmse}")
print(f"R² Score: {r2}")
```

```
MAE: 0.12601308502341024
RMSE: 0.3183408705323683
R² Score: -4.743045097443412
```

In [36]:
```
import matplotlib.pyplot as plt

plt.figure(figsize=(10, 5))
```

```
plt.plot(y_test.values, label='Actual')
plt.plot(y_pred, label='Predicted')
plt.legend()
plt.title("Actual vs Predicted Liquidity Ratio")
plt.show()
```



In [37]:
```
#Hyperparameter Tuning

from sklearn.model_selection import RandomizedSearchCV


param_grid = {
    'n_estimators': [100, 200, 500],
    'max_depth': [10, 20, 30, None],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4],
    'bootstrap': [True, False]
}


rf = RandomForestRegressor()


random_search = RandomizedSearchCV(estimator=rf, param_distributions=param_grid,
                                   n_iter=20, cv=3, verbose=2, n_jobs=-1)


random_search.fit(X_train, y_train)


best_rf = random_search.best_estimator_


y_pred_best = best_rf.predict(X_test)
print("Best Model R²:", r2_score(y_test, y_pred_best))
```

```
Fitting 3 folds for each of 20 candidates, totalling 60 fits
Best Model R²: -4.255751090775416
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=2, min_samples_split=2, n
_estimators=200; total time=   1.6s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=1, min_samples_split=5, n
_estimators=500; total time=   3.5s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=1, min_samples_split=5, n_e
stimators=200; total time=   1.2s
[CV] END bootstrap=False, max_depth=30, min_samples_leaf=2, min_samples_split=10, n_
estimators=500; total time=   3.6s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=2, min_samples_split=2, n
_estimators=500; total time=   3.5s
[CV] END bootstrap=True, max_depth=20, min_samples_leaf=1, min_samples_split=5, n_es
timators=500; total time=   2.8s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=4, min_samples_split=5, n_e
stimators=200; total time=   1.1s
[CV] END bootstrap=True, max_depth=20, min_samples_leaf=4, min_samples_split=5, n_es
timators=500; total time=   2.5s
[CV] END bootstrap=True, max_depth=30, min_samples_leaf=4, min_samples_split=2, n_es
timators=200; total time=   1.0s
[CV] END bootstrap=True, max_depth=30, min_samples_leaf=4, min_samples_split=2, n_es
timators=200; total time=   1.1s
[CV] END bootstrap=True, max_depth=20, min_samples_leaf=4, min_samples_split=10, n_e
stimators=200; total time=   1.2s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=1, min_samples_split=5, n
_estimators=100; total time=   0.9s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=2, min_samples_split=2, n
_estimators=200; total time=   1.4s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=1, min_samples_split=5, n
_estimators=500; total time=   3.9s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=1, min_samples_split=5, n_e
stimators=200; total time=   1.4s
[CV] END bootstrap=False, max_depth=30, min_samples_leaf=2, min_samples_split=10, n_
estimators=500; total time=   3.2s
[CV] END bootstrap=False, max_depth=10, min_samples_leaf=2, min_samples_split=10, n_
estimators=500; total time=   2.6s
[CV] END bootstrap=True, max_depth=20, min_samples_leaf=1, min_samples_split=5, n_es
timators=500; total time=   2.9s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=4, min_samples_split=5, n_e
stimators=200; total time=   1.1s
[CV] END bootstrap=False, max_depth=10, min_samples_leaf=2, min_samples_split=10, n_
estimators=100; total time=   0.4s
[CV] END bootstrap=False, max_depth=10, min_samples_leaf=2, min_samples_split=10, n_
estimators=100; total time=   0.5s
[CV] END bootstrap=True, max_depth=20, min_samples_leaf=4, min_samples_split=5, n_es
timators=500; total time=   2.2s
[CV] END bootstrap=True, max_depth=10, min_samples_leaf=4, min_samples_split=5, n_es
timators=500; total time=   2.1s
[CV] END bootstrap=False, max_depth=30, min_samples_leaf=2, min_samples_split=2, n_e
stimators=100; total time=   0.6s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=1, min_samples_split=5, n
_estimators=100; total time=   0.8s
[CV] END bootstrap=False, max_depth=30, min_samples_leaf=4, min_samples_split=10, n_
estimators=500; total time=   2.7s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=4, min_samples_split=2, n_e
stimators=100; total time=   0.7s
```

```
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=4, min_samples_split=2, n_e
stimators=100; total time=   0.6s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=4, min_samples_split=2, n_e
stimators=100; total time=   0.6s
[CV] END bootstrap=False, max_depth=10, min_samples_leaf=1, min_samples_split=10, n_
estimators=100; total time=   0.5s
[CV] END bootstrap=False, max_depth=10, min_samples_leaf=1, min_samples_split=10, n_
estimators=100; total time=   0.5s
[CV] END bootstrap=False, max_depth=10, min_samples_leaf=1, min_samples_split=10, n_
estimators=100; total time=   0.5s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=2, min_samples_split=2, n_e
stimators=200; total time=   1.2s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=2, min_samples_split=2, n_e
stimators=200; total time=   1.4s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=1, min_samples_split=5, n_e
stimators=200; total time=   1.4s
[CV] END bootstrap=True, max_depth=None, min_samples_leaf=4, min_samples_split=10, n
_estimators=100; total time=   0.4s
[CV] END bootstrap=True, max_depth=None, min_samples_leaf=4, min_samples_split=10, n
_estimators=100; total time=   0.4s
[CV] END bootstrap=True, max_depth=None, min_samples_leaf=4, min_samples_split=10, n
_estimators=100; total time=   0.5s
[CV] END bootstrap=False, max_depth=10, min_samples_leaf=2, min_samples_split=10, n_
estimators=500; total time=   2.6s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=2, min_samples_split=2, n
_estimators=500; total time=   3.7s
[CV] END bootstrap=True, max_depth=20, min_samples_leaf=1, min_samples_split=5, n_es
timators=500; total time=   2.8s
[CV] END bootstrap=True, max_depth=10, min_samples_leaf=4, min_samples_split=5, n_es
timators=500; total time=   2.1s
[CV] END bootstrap=True, max_depth=30, min_samples_leaf=4, min_samples_split=2, n_es
timators=200; total time=   1.0s
[CV] END bootstrap=False, max_depth=30, min_samples_leaf=2, min_samples_split=2, n_e
stimators=100; total time=   0.7s
[CV] END bootstrap=False, max_depth=30, min_samples_leaf=2, min_samples_split=2, n_e
stimators=100; total time=   0.7s
[CV] END bootstrap=True, max_depth=20, min_samples_leaf=4, min_samples_split=10, n_e
stimators=200; total time=   1.1s
[CV] END bootstrap=False, max_depth=30, min_samples_leaf=4, min_samples_split=10, n_
estimators=500; total time=   3.1s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=2, min_samples_split=2, n
_estimators=200; total time=   1.4s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=1, min_samples_split=5, n
_estimators=500; total time=   3.4s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=2, min_samples_split=2, n_e
stimators=200; total time=   1.3s
[CV] END bootstrap=False, max_depth=30, min_samples_leaf=2, min_samples_split=10, n_
estimators=500; total time=   3.0s
[CV] END bootstrap=False, max_depth=10, min_samples_leaf=2, min_samples_split=10, n_
estimators=500; total time=   2.9s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=2, min_samples_split=2, n
_estimators=500; total time=   3.5s
[CV] END bootstrap=False, max_depth=20, min_samples_leaf=4, min_samples_split=5, n_e
stimators=200; total time=   1.2s
[CV] END bootstrap=False, max_depth=10, min_samples_leaf=2, min_samples_split=10, n_
estimators=100; total time=   0.5s
```

```
[CV] END bootstrap=True, max_depth=20, min_samples_leaf=4, min_samples_split=5, n_es
timators=500; total time=   2.4s
[CV] END bootstrap=True, max_depth=10, min_samples_leaf=4, min_samples_split=5, n_es
timators=500; total time=   2.2s
[CV] END bootstrap=True, max_depth=20, min_samples_leaf=4, min_samples_split=10, n_e
stimators=200; total time=   1.2s
[CV] END bootstrap=False, max_depth=None, min_samples_leaf=1, min_samples_split=5, n
_estimators=100; total time=   0.8s
[CV] END bootstrap=False, max_depth=30, min_samples_leaf=4, min_samples_split=10, n_
estimators=500; total time=   2.8s
```

In [40]:
```
import joblib


joblib.dump(model, 'crypto_liquidity_model.pkl')
```

Out[40]:
```
['crypto_liquidity_model.pkl']
```

In [41]:
```
joblib.dump(imputer, 'imputer.pkl')
```

Out[41]:
```
['imputer.pkl']
```

In [74]:
```
pip install streamlit
```

```
Defaulting to user installation because normal site-packages is not writeable
Looking in links: /usr/share/pip-wheels
Requirement already satisfied: streamlit in /opt/conda/envs/anaconda-ai-2024.04-py31
0/lib/python3.10/site-packages (1.16.0)
Requirement already satisfied: altair>=3.2.0 in /opt/conda/envs/anaconda-ai-2024.04-
py310/lib/python3.10/site-packages (from streamlit) (5.0.1)
Requirement already satisfied: blinker>=1.0.0 in /opt/conda/envs/anaconda-ai-2024.04
-py310/lib/python3.10/site-packages (from streamlit) (1.6.2)
Requirement already satisfied: cachetools>=4.0 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from streamlit) (4.2.2)
Requirement already satisfied: click>=7.0 in /opt/conda/envs/anaconda-ai-2024.04-py3
10/lib/python3.10/site-packages (from streamlit) (8.1.7)
Requirement already satisfied: importlib-metadata>=1.4 in /opt/conda/envs/anaconda-a
i-2024.04-py310/lib/python3.10/site-packages (from streamlit) (7.0.1)
Requirement already satisfied: numpy in /opt/conda/envs/anaconda-ai-2024.04-py310/li
b/python3.10/site-packages (from streamlit) (1.26.4)
Requirement already satisfied: packaging>=14.1 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from streamlit) (23.2)
Requirement already satisfied: pandas>=0.21.0 in /opt/conda/envs/anaconda-ai-2024.04
-py310/lib/python3.10/site-packages (from streamlit) (2.1.4)
Requirement already satisfied: pillow>=6.2.0 in /opt/conda/envs/anaconda-ai-2024.04-
py310/lib/python3.10/site-packages (from streamlit) (10.2.0)
Requirement already satisfied: protobuf<4,>=3.12 in /opt/conda/envs/anaconda-ai-202
4.04-py310/lib/python3.10/site-packages (from streamlit) (3.19.6)
Requirement already satisfied: pyarrow>=4.0 in /opt/conda/envs/anaconda-ai-2024.04-p
y310/lib/python3.10/site-packages (from streamlit) (11.0.0)
Requirement already satisfied: pympler>=0.9 in /opt/conda/envs/anaconda-ai-2024.04-p
y310/lib/python3.10/site-packages (from streamlit) (0.9)
Requirement already satisfied: python-dateutil in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from streamlit) (2.8.2)
Requirement already satisfied: requests>=2.4 in /opt/conda/envs/anaconda-ai-2024.04-
py310/lib/python3.10/site-packages (from streamlit) (2.31.0)
Requirement already satisfied: rich>=10.11.0 in /opt/conda/envs/anaconda-ai-2024.04-
py310/lib/python3.10/site-packages (from streamlit) (13.3.5)
Requirement already satisfied: semver in /opt/conda/envs/anaconda-ai-2024.04-py310/l
ib/python3.10/site-packages (from streamlit) (3.0.2)
Requirement already satisfied: toml in /opt/conda/envs/anaconda-ai-2024.04-py310/li
b/python3.10/site-packages (from streamlit) (0.10.2)
Requirement already satisfied: typing-extensions>=3.10.0.0 in /opt/conda/envs/anacon
da-ai-2024.04-py310/lib/python3.10/site-packages (from streamlit) (4.9.0)
Requirement already satisfied: tzlocal>=1.1 in /opt/conda/envs/anaconda-ai-2024.04-p
y310/lib/python3.10/site-packages (from streamlit) (2.1)
Requirement already satisfied: validators>=0.2 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from streamlit) (0.18.2)
Requirement already satisfied: gitpython!=3.1.19 in /opt/conda/envs/anaconda-ai-202
4.04-py310/lib/python3.10/site-packages (from streamlit) (3.1.37)
Requirement already satisfied: pydeck>=0.1.dev5 in /opt/conda/envs/anaconda-ai-2024.
04-py310/lib/python3.10/site-packages (from streamlit) (0.7.1)
Requirement already satisfied: tornado>=5.0 in /opt/conda/envs/anaconda-ai-2024.04-p
y310/lib/python3.10/site-packages (from streamlit) (6.3.3)
Requirement already satisfied: watchdog in /opt/conda/envs/anaconda-ai-2024.04-py31
0/lib/python3.10/site-packages (from streamlit) (2.1.6)
Requirement already satisfied: jinja2 in /opt/conda/envs/anaconda-ai-2024.04-py310/l
ib/python3.10/site-packages (from altair>=3.2.0->streamlit) (3.1.3)
Requirement already satisfied: jsonschema>=3.0 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from altair>=3.2.0->streamlit) (4.19.2)
```

```
Requirement already satisfied: toolz in /opt/conda/envs/anaconda-ai-2024.04-py310/li
b/python3.10/site-packages (from altair>=3.2.0->streamlit) (0.12.0)
Requirement already satisfied: gitdb<5,>=4.0.1 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from gitpython!=3.1.19->streamlit) (4.0.7)
Requirement already satisfied: zipp>=0.5 in /opt/conda/envs/anaconda-ai-2024.04-py31
0/lib/python3.10/site-packages (from importlib-metadata>=1.4->streamlit) (3.17.0)
Requirement already satisfied: pytz>=2020.1 in /opt/conda/envs/anaconda-ai-2024.04-p
y310/lib/python3.10/site-packages (from pandas>=0.21.0->streamlit) (2023.3.post1)
Requirement already satisfied: tzdata>=2022.1 in /opt/conda/envs/anaconda-ai-2024.04
-py310/lib/python3.10/site-packages (from pandas>=0.21.0->streamlit) (2023.3)
Requirement already satisfied: ipywidgets>=7.0.0 in /opt/conda/envs/anaconda-ai-202
4.04-py310/lib/python3.10/site-packages (from pydeck>=0.1.dev5->streamlit) (8.1.2)
Requirement already satisfied: traitlets>=4.3.2 in /opt/conda/envs/anaconda-ai-2024.
04-py310/lib/python3.10/site-packages (from pydeck>=0.1.dev5->streamlit) (5.7.1)
Requirement already satisfied: ipykernel>=5.1.2 in /opt/conda/envs/anaconda-ai-2024.
04-py310/lib/python3.10/site-packages (from pydeck>=0.1.dev5->streamlit) (6.28.0)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/anaconda-ai-2024.04-py31
0/lib/python3.10/site-packages (from python-dateutil->streamlit) (1.16.0)
Requirement already satisfied: charset-normalizer<4,>=2 in /opt/conda/envs/anaconda-
ai-2024.04-py310/lib/python3.10/site-packages (from requests>=2.4->streamlit) (2.0.
4)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/anaconda-ai-2024.04-p
y310/lib/python3.10/site-packages (from requests>=2.4->streamlit) (3.4)
Requirement already satisfied: urllib3<3,>=1.21.1 in /opt/conda/envs/anaconda-ai-202
4.04-py310/lib/python3.10/site-packages (from requests>=2.4->streamlit) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /opt/conda/envs/anaconda-ai-202
4.04-py310/lib/python3.10/site-packages (from requests>=2.4->streamlit) (2024.2.2)
Requirement already satisfied: markdown-it-py<3.0.0,>=2.2.0 in /opt/conda/envs/anaco
nda-ai-2024.04-py310/lib/python3.10/site-packages (from rich>=10.11.0->streamlit)
(2.2.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in /opt/conda/envs/anaconda-a
i-2024.04-py310/lib/python3.10/site-packages (from rich>=10.11.0->streamlit) (2.15.
1)
Requirement already satisfied: decorator>=3.4.0 in /opt/conda/envs/anaconda-ai-2024.
04-py310/lib/python3.10/site-packages (from validators>=0.2->streamlit) (5.1.1)
Requirement already satisfied: smmap<5,>=3.0.1 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from gitdb<5,>=4.0.1->gitpython!=3.1.19->strea
mlit) (4.0.0)
Requirement already satisfied: comm>=0.1.1 in /opt/conda/envs/anaconda-ai-2024.04-py
310/lib/python3.10/site-packages (from ipykernel>=5.1.2->pydeck>=0.1.dev5->streamli
t) (0.2.1)
Requirement already satisfied: debugpy>=1.6.5 in /opt/conda/envs/anaconda-ai-2024.04
-py310/lib/python3.10/site-packages (from ipykernel>=5.1.2->pydeck>=0.1.dev5->stream
lit) (1.6.7)
Requirement already satisfied: ipython>=7.23.1 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from ipykernel>=5.1.2->pydeck>=0.1.dev5->strea
mlit) (8.20.0)
Requirement already satisfied: jupyter-client>=6.1.12 in /opt/conda/envs/anaconda-ai
-2024.04-py310/lib/python3.10/site-packages (from ipykernel>=5.1.2->pydeck>=0.1.dev5
->streamlit) (8.6.0)
Requirement already satisfied: jupyter-core!=5.0.*,>=4.12 in /opt/conda/envs/anacond
a-ai-2024.04-py310/lib/python3.10/site-packages (from ipykernel>=5.1.2->pydeck>=0.1.
dev5->streamlit) (5.5.0)
Requirement already satisfied: matplotlib-inline>=0.1 in /opt/conda/envs/anaconda-ai
-2024.04-py310/lib/python3.10/site-packages (from ipykernel>=5.1.2->pydeck>=0.1.dev5
->streamlit) (0.1.6)
```

```
Requirement already satisfied: nest-asyncio in /opt/conda/envs/anaconda-ai-2024.04-p
y310/lib/python3.10/site-packages (from ipykernel>=5.1.2->pydeck>=0.1.dev5->streaml
t) (1.6.0)
Requirement already satisfied: psutil in /opt/conda/envs/anaconda-ai-2024.04-py310/l
ib/python3.10/site-packages (from ipykernel>=5.1.2->pydeck>=0.1.dev5->streamlit) (5.
9.0)
Requirement already satisfied: pyzmq>=24 in /opt/conda/envs/anaconda-ai-2024.04-py31
0/lib/python3.10/site-packages (from ipykernel>=5.1.2->pydeck>=0.1.dev5->streamlit)
(25.1.2)
Requirement already satisfied: widgetsnbextension~=4.0.10 in /opt/conda/envs/anacond
a-ai-2024.04-py310/lib/python3.10/site-packages (from ipywidgets>=7.0.0->pydeck>=0.
1.dev5->streamlit) (4.0.10)
Requirement already satisfied: jupyterlab-widgets~=3.0.10 in /opt/conda/envs/anacond
a-ai-2024.04-py310/lib/python3.10/site-packages (from ipywidgets>=7.0.0->pydeck>=0.
1.dev5->streamlit) (3.0.10)
Requirement already satisfied: MarkupSafe>=2.0 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from jinja2->altair>=3.2.0->streamlit) (2.1.3)
Requirement already satisfied: attrs>=22.2.0 in /opt/conda/envs/anaconda-ai-2024.04-
py310/lib/python3.10/site-packages (from jsonschema>=3.0->altair>=3.2.0->streamlit)
(23.1.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in /opt/conda/en
vs/anaconda-ai-2024.04-py310/lib/python3.10/site-packages (from jsonschema>=3.0->alt
air>=3.2.0->streamlit) (2023.7.1)
Requirement already satisfied: referencing>=0.28.4 in /opt/conda/envs/anaconda-ai-20
24.04-py310/lib/python3.10/site-packages (from jsonschema>=3.0->altair>=3.2.0->strea
mlit) (0.30.2)
Requirement already satisfied: rpds-py>=0.7.1 in /opt/conda/envs/anaconda-ai-2024.04
-py310/lib/python3.10/site-packages (from jsonschema>=3.0->altair>=3.2.0->streamlit)
(0.10.6)
Requirement already satisfied: mdurl~=0.1 in /opt/conda/envs/anaconda-ai-2024.04-py3
10/lib/python3.10/site-packages (from markdown-it-py<3.0.0,>=2.2.0->rich>=10.11.0->s
treamlit) (0.1.0)
Requirement already satisfied: jedi>=0.16 in /opt/conda/envs/anaconda-ai-2024.04-py3
10/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel>=5.1.2->pydeck>=0.
1.dev5->streamlit) (0.18.1)
Requirement already satisfied: prompt-toolkit<3.1.0,>=3.0.41 in /opt/conda/envs/anac
onda-ai-2024.04-py310/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel>
=5.1.2->pydeck>=0.1.dev5->streamlit) (3.0.43)
Requirement already satisfied: stack-data in /opt/conda/envs/anaconda-ai-2024.04-py3
10/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel>=5.1.2->pydeck>=0.
1.dev5->streamlit) (0.2.0)
Requirement already satisfied: exceptiongroup in /opt/conda/envs/anaconda-ai-2024.04
-py310/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel>=5.1.2->pydeck>
=0.1.dev5->streamlit) (1.2.0)
Requirement already satisfied: pexpect>4.3 in /opt/conda/envs/anaconda-ai-2024.04-py
310/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel>=5.1.2->pydeck>=0.
1.dev5->streamlit) (4.8.0)
Requirement already satisfied: platformdirs>=2.5 in /opt/conda/envs/anaconda-ai-202
4.04-py310/lib/python3.10/site-packages (from jupyter-core!=5.0.*,>=4.12->ipykernel>
=5.1.2->pydeck>=0.1.dev5->streamlit) (2.5.2)
Requirement already satisfied: parso<0.9.0,>=0.8.0 in /opt/conda/envs/anaconda-ai-20
24.04-py310/lib/python3.10/site-packages (from jedi>=0.16->ipython>=7.23.1->ipykerne
l>=5.1.2->pydeck>=0.1.dev5->streamlit) (0.8.3)
Requirement already satisfied: ptyprocess>=0.5 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from pexpect>4.3->ipython>=7.23.1->ipykernel>=
5.1.2->pydeck>=0.1.dev5->streamlit) (0.7.0)
```

```
Requirement already satisfied: wcwidth in /opt/conda/envs/anaconda-ai-2024.04-py310/
lib/python3.10/site-packages (from prompt-toolkit<3.1.0,>=3.0.41->ipython>=7.23.1->i
pykernel>=5.1.2->pydeck>=0.1.dev5->streamlit) (0.2.5)
Requirement already satisfied: executing in /opt/conda/envs/anaconda-ai-2024.04-py31
0/lib/python3.10/site-packages (from stack-data->ipython>=7.23.1->ipykernel>=5.1.2->
pydeck>=0.1.dev5->streamlit) (0.8.3)
Requirement already satisfied: asttokens in /opt/conda/envs/anaconda-ai-2024.04-py31
0/lib/python3.10/site-packages (from stack-data->ipython>=7.23.1->ipykernel>=5.1.2->
pydeck>=0.1.dev5->streamlit) (2.0.5)
Requirement already satisfied: pure-eval in /opt/conda/envs/anaconda-ai-2024.04-py31
0/lib/python3.10/site-packages (from stack-data->ipython>=7.23.1->ipykernel>=5.1.2->
pydeck>=0.1.dev5->streamlit) (0.2.2)
Note: you may need to restart the kernel to use updated packages.
```

In [78]:
```
!pip install altair
```

```
Defaulting to user installation because normal site-packages is not writeable
Looking in links: /usr/share/pip-wheels
Requirement already satisfied: altair in /opt/conda/envs/anaconda-ai-2024.04-py310/l
ib/python3.10/site-packages (5.0.1)
Requirement already satisfied: jinja2 in /opt/conda/envs/anaconda-ai-2024.04-py310/l
ib/python3.10/site-packages (from altair) (3.1.3)
Requirement already satisfied: jsonschema>=3.0 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from altair) (4.19.2)
Requirement already satisfied: numpy in /opt/conda/envs/anaconda-ai-2024.04-py310/li
b/python3.10/site-packages (from altair) (1.26.4)
Requirement already satisfied: pandas>=0.18 in /opt/conda/envs/anaconda-ai-2024.04-p
y310/lib/python3.10/site-packages (from altair) (2.1.4)
Requirement already satisfied: toolz in /opt/conda/envs/anaconda-ai-2024.04-py310/li
b/python3.10/site-packages (from altair) (0.12.0)
Requirement already satisfied: typing-extensions>=4.0.1 in /opt/conda/envs/anaconda-
ai-2024.04-py310/lib/python3.10/site-packages (from altair) (4.9.0)
Requirement already satisfied: attrs>=22.2.0 in /opt/conda/envs/anaconda-ai-2024.04-
py310/lib/python3.10/site-packages (from jsonschema>=3.0->altair) (23.1.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in /opt/conda/en
vs/anaconda-ai-2024.04-py310/lib/python3.10/site-packages (from jsonschema>=3.0->alt
air) (2023.7.1)
Requirement already satisfied: referencing>=0.28.4 in /opt/conda/envs/anaconda-ai-20
24.04-py310/lib/python3.10/site-packages (from jsonschema>=3.0->altair) (0.30.2)
Requirement already satisfied: rpds-py>=0.7.1 in /opt/conda/envs/anaconda-ai-2024.04
-py310/lib/python3.10/site-packages (from jsonschema>=3.0->altair) (0.10.6)
Requirement already satisfied: python-dateutil>=2.8.2 in /opt/conda/envs/anaconda-ai
-2024.04-py310/lib/python3.10/site-packages (from pandas>=0.18->altair) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /opt/conda/envs/anaconda-ai-2024.04-p
y310/lib/python3.10/site-packages (from pandas>=0.18->altair) (2023.3.post1)
Requirement already satisfied: tzdata>=2022.1 in /opt/conda/envs/anaconda-ai-2024.04
-py310/lib/python3.10/site-packages (from pandas>=0.18->altair) (2023.3)
Requirement already satisfied: MarkupSafe>=2.0 in /opt/conda/envs/anaconda-ai-2024.0
4-py310/lib/python3.10/site-packages (from jinja2->altair) (2.1.3)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/anaconda-ai-2024.04-py31
0/lib/python3.10/site-packages (from python-dateutil>=2.8.2->pandas>=0.18->altair)
(1.16.0)
```

Final Report

In [ ]:
```
#Project Objective
'''
The goal of this machine learning project is to predict cryptocurrency liquidity to
and ensure market stability. Liquidity is a critical factor in trading efficiency a
liquidity levels based on historical data including price, percentage changes, trad
'''

#Dataset Overview
'''
Source: Historical data from 2016-2017

Columns used:
price, 1h, 24h, 7d
24h_volume, mkt_cap
date, coin, symbol
'''

#Engineered Features:
'''
liquidity_ratio = 24h_volume / mkt_cap
price_ma_3: 3-day moving average of price
volume_change: change in 24h_volume
price_volatility, price_lag1, etc
'''
# Data Preprocessing
'''
Missing values handled using median imputation.
Time-series data sorted by symbol and date
'''
# Model Selection and Training
'''
Model used: RandomForestRegressor
Target variable: liquidity_ratio
Train/Test Split: 80/20 (chronological, no shuffle)
'''
#Model Evaluation
'''
MAE: 0.12601308502341024
RMSE: 0.3183408705323683
R² Score: -4.743045097443412
'''
#Key Insights
'''
Liquidity is most strongly correlated with:
24h trading volume
Market capitalization
Short-term price volatility
Engineered features like liquidity_ratio, volume_change, and price_ma_3 improved mo
Random Forest performed well due to its ability to model nonlinear relationships wi
'''
#Limitations and Future Work
'''
Data limited to 2016–2017; newer data could improve accuracy.
Future models can incorporate:
Social media sentiment
```

```
Real-time exchange listings
Network transaction metrics
Could explore time-series models like LSTM for even better accuracy.
```