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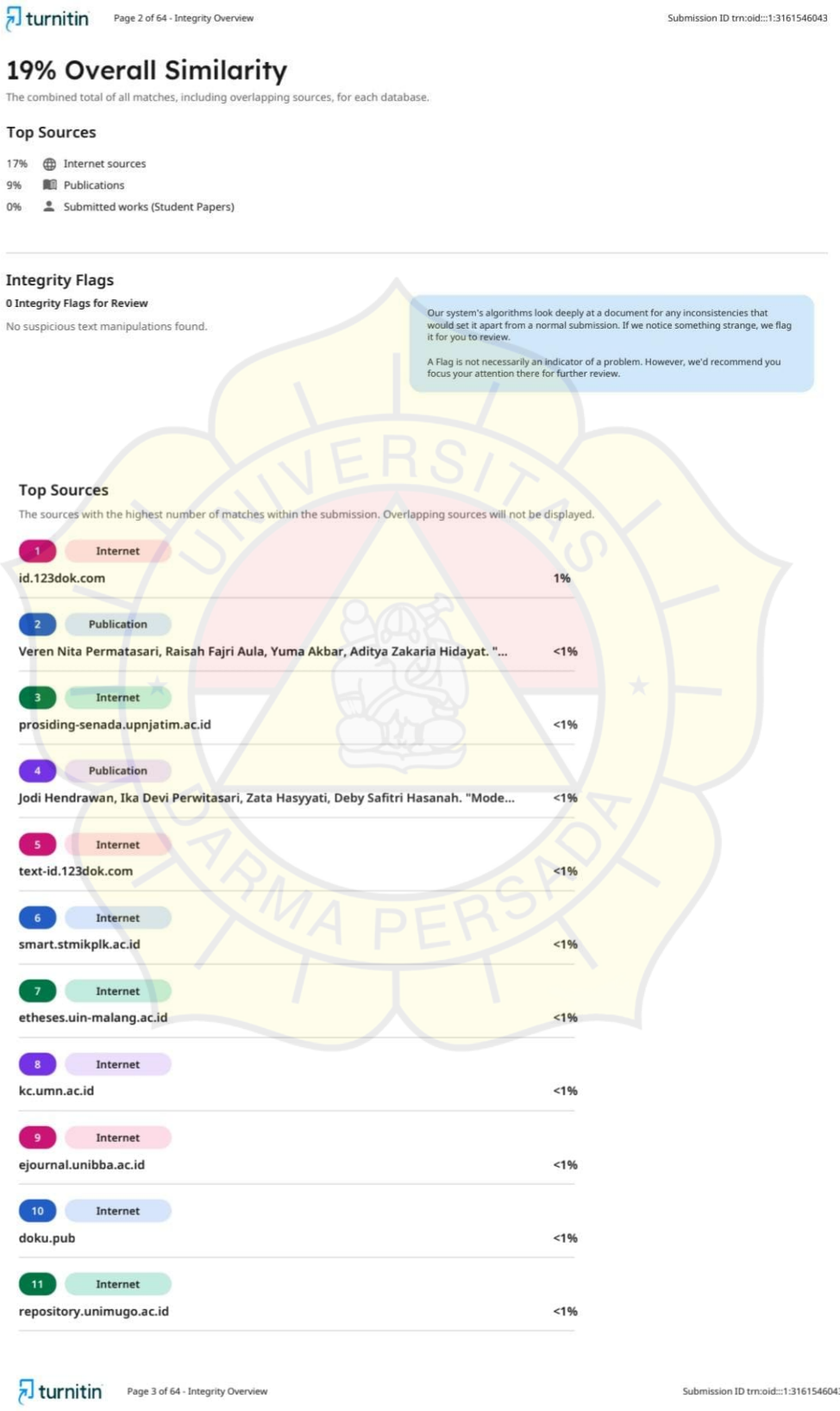

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Lampiran 3. Codingan Python

```
import streamlit as st
import pandas as pd
import matplotlib.pyplot as plt
import io
import base64
import time
from pymongo import MongoClient, errors
from statsmodels.tsa.arima.model import ARIMA
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler, LabelEncoder
from datetime import datetime
from sklearn.metrics import silhouette_score,
calinski_harabasz_score
from sklearn.decomposition import PCA
import numpy as np
from statsmodels.tsa.stattools import adfuller
from sklearn.metrics import mean_squared_error
from sklearn.metrics import mean_absolute_error
import itertools

# MongoDB connection with error handlingecho "# ForecastApp" >>
README.md
try:
    client =
MongoClient("mongodb+srv://krisna:krisna@cluster0.3mao11f.mongodb.
net/?retryWrites=true&w=majority&appName=Cluster0")
    db = client['dbkrisna']
    collection_visualisasi = db['visualisasi']
    collection_history = db['history']
except errors.ConnectionError as e:
    st.error("Could not connect to MongoDB. Please check your
connection settings.")
    st.stop()  # Stop the app if the connection fails

# User management
users = {
    "admin": {"password": "admin", "role": "admin"},
    "upst": {"password": "admin", "role": "user"},
    "psm": {"password": "admin", "role": "user"}
}

def add_user(username, password):
    if username not in users:
        users[username] = {"password": password, "role": "user"}
        return True
    return False

def edit_user(username, new_password=None):
    if username in users:
        if new_password:
            users[username]["password"] = new_password
```

```
        return True
    return False

def delete_user(username):
    if username in users and username != "admin":   # Prevent
deletion of admin
        del users[username]
        return True
    return False

def login():
    st.title("Login")
    username = st.text_input("Username")
    password = st.text_input("Password", type="password")
    if st.button("Login"):
        if username in users and users[username]  ["password"] ==
password:
            st.session_state['logged_in'] = True
            st.session_state['role'] = users[username]["role"]
            st.session_state['username'] = username
            st.rerun()
        else:
            st.error("Username atau password salah")

def clear_collection(collection):
    with st.spinner("Mengosongkan collection..."):
        collection.delete_many({})
        st.success("Collection berhasil dikosongkan!")

def delete_history_by_collection_name(collection_name):
    with        st.spinner(f"Menghapus        semua        riwayat
'{collection_name}'..."):
        collection_history.delete_many({"collection_name":
collection_name})

def load_data(collection):
    progress_bar = st.progress(0)
    status_text = st.empty()
    cursor = collection.find()
    data_list = []
    total = collection.count_documents({})
    count = 0

    for doc in cursor:
        data_list.append(doc)
        count += 1
        progress = int((count / total) * 100)
        progress_bar.progress(progress)
        status_text.text(f"Memuat data... {progress}%")
        time.sleep(0.01)

    progress_bar.empty()
    status_text.text("Memuat data selesai!")
    data = pd.DataFrame(data_list)
    return data
```

```
def save_data(collection, data):
    collection.delete_many({})
    progress_bar = st.progress(0)
    status_text = st.empty()
    records = data.to_dict('records')
    total = len(records)
    batch_size = 10

    for i in range(0, total, batch_size):
        batch = records[i:i+batch_size]
        collection.insert_many(batch)
        progress = int(((i + len(batch)) / total) * 100)
        progress_bar.progress(progress)
        status_text.text(f"Menyimpan data... {progress}%")
        time.sleep(0.01)

    progress_bar.empty()
    status_text.success("Data berhasil diunggah!")

def save_history(*args, collection_name):
    with st.spinner("Menyimpan riwayat data..."):
        history_data = {}
        for i, data in enumerate(args):
            if isinstance(data, plt.Figure):
                img_stream = io.BytesIO()

data.savefig(img_stream, format='png')
                img_stream.seek(0)
                img_data                                                =
base64.b64encode(img_stream.read()).decode('utf-8')
                history_data[f"fig_{i+1}"] = img_data
            else:
                history_data[f"data_{i+1}"]                             =
data.to_dict('records')

        history = {
            "collection_name": collection_name,
            "data": history_data,
            "timestamp":        datetime.now().strftime("%Y-%m-%d
%H:%M:%S")
        }
        collection_history.insert_one(history)

def load_history(collection_name=None):
    with st.spinner("Memuat riwayat data..."):
        if collection_name:
            history                                                     =
pd.DataFrame(list(collection_history.find({"collection_name":
collection_name})))
        else:
            history                                                     =
pd.DataFrame(list(collection_history.find()))
    return history

def delete_history(history_id):
```

```
    with st.spinner("Menghapus riwayat data..."):
        collection_history.delete_one({'_id': history_id})

def show_image_from_history(img_data):
    img = base64.b64decode(img_data)
    st.image(img, use_container_width=True)

def arima_prediction(data):
    with st.spinner("Membuat prediksi ARIMA..."):
        month_mapping = {
            "Januari": 1, "Februari": 2, "Maret": 3, "April": 4,
            "Mei": 5, "Juni": 6, "Juli": 7, "Agustus": 8,
            "September":  9,  "Oktober":  10,  "November":  11,
"Desember": 12
        }

        df_arima = data.copy()
        df_arima['month'] = df_arima['Bulan'].map(month_mapping)
        df_arima['year'] = df_arima['Tahun'].astype(int)
        df_arima['date'] = pd.to_datetime(
            df_arima[['year',          'month']].assign(Day=1),
errors='coerce'
        )

        df_arima                                                =
pd.DataFrame(df_arima.groupby('date')['Tonase'].sum())
        ts_data = df_arima['Tonase']

        st.write("Hasil ADF Test sebelum differencing:")
        adf_test(ts_data)

        if adfuller(ts_data)[1] > 0.05:
            ts_data = ts_data.diff().dropna()
            st.write("\nHasil ADF Test setelah differencing:")
            adf_test(ts_data)

        train_size = int(len(ts_data) * 0.95)
        train, test = ts_data[:train_size], ts_data[train_size:]

        p, d, q = 9, 5, 4
        model = ARIMA(train, order=(p, d, q))
        model_fit = model.fit()

        forecast = model_fit.forecast(steps=len(test))
        forecast_series = pd.Series(forecast, index=test.index)

        mae = mean_absolute_error(test, forecast_series)
        mape = np.mean(np.abs((test - forecast_series) / test)) *
100
        rmse = np.sqrt(mean_squared_error(test, forecast_series))

        st.write("\nEvaluasi Model:")
        st.write(f"MAE: {mae}")
        st.write(f"MAPE: {mape}%")
        st.write(f"RMSE: {rmse}")
```

```
        full_series = pd.concat([train, test])
        forecast_series_full = pd.concat([train, forecast_series])

        fig, ax = plt.subplots(figsize=(10, 6))
        ax.plot(forecast_series_full,            label="Forecast",
color='red')
        ax.plot(train, label="Actual", color='blue')
        ax.set_title("ARIMA Model - Actual vs Forecast")
        ax.set_xlabel(None)
        ax.set_ylabel("Tonase")
        ax.legend()
        ax.grid()

        st.pyplot(fig)

    return fig

def adf_test(series):
    result = adfuller(series)
    st.write("ADF Test Statistic:", result[0])
    st.write("p-value:", result[1])
    st.write("Critical Values:")
    for key, value in result[4].items():
        st.write(f"   {key}: {value}")
    if result[1] <= 0.05:
        st.write("Data stasioner (H0 ditolak).")
    else:
        st.write("Data tidak stasioner (H0 diterima).")

def kmeans_prediction(data):
    with st.spinner("Membuat prediksi KMeans..."):
        data = data.copy()
        features    =    ['kota_kabupaten_code',    'tahun_code',
'bulan_code', 'Tonase']
        X = data[features]
        scaler = StandardScaler()
        X_scaled = scaler.fit_transform(X)

        inertia = []
        k_range = range(2, 11)
        for k in k_range:
            kmeans = KMeans(n_clusters=k, random_state=42)
            kmeans.

fit(X_scaled)
            inertia.append(kmeans.inertia_)

        fig_elbow, ax = plt.subplots(figsize=(8, 5))
        ax.plot(k_range, inertia, marker='o')
        ax.set_title("Elbow Method")
        ax.set_xlabel("Number of Clusters")
        ax.set_ylabel("Inertia")
        ax.set_xticks(k_range)
        ax.grid()
```

```
        st.pyplot(fig_elbow)

        silhouette_scores = []
        for k in k_range:
            kmeans = KMeans(n_clusters=k, random_state=42)
            kmeans.fit(X_scaled)
            labels = kmeans.labels_
            score = silhouette_score(X_scaled, labels)
            silhouette_scores.append(score)

        fig_silhoute, ax = plt.subplots(figsize=(8, 5))
        ax.plot(k_range,      silhouette_scores,      marker='o',
color='orange')
        ax.set_title("Silhouette Score")
        ax.set_xlabel("Number of Clusters")
        ax.set_ylabel("Silhouette Score")
        ax.set_xticks(k_range)
        ax.grid()
        st.pyplot(fig_silhoute)

        optimal_k = k_range[np.argmax(silhouette_scores)]
        st.write(f'Jumlah cluster optimal berdasarkan Silhouette
Score: {optimal_k}')

        kmeans_optimal       =       KMeans(n_clusters=optimal_k,
random_state=42)
        kmeans_optimal.fit(X_scaled)
        data['cluster'] = kmeans_optimal.labels_

        # Define waste categories based on Tonase
        def categorize_waste(t):
            if t > 5000:
                return 'Large'
            elif t > 2000:
                return 'Medium'
            else:
                return 'Small'

        data['Waste_Category']                                    =
data['Tonase'].apply(categorize_waste)

        # Create a summary table for cities with their waste
categories and tonnage
        summary_table = data[['Kota / Kabupaten', 'Waste_Category',
'Tonase']].copy()
        summary_table = summary_table.groupby(['Kota / Kabupaten',
'Waste_Category']).agg(
            Total_Tonase=('Tonase', 'sum')
        ).reset_index()

        st.subheader("City Waste Summary")
        st.dataframe(summary_table)

        # Visualize the clusters
        pca = PCA(n_components=2)
```

```
        X_pca = pca.fit_transform(X_scaled)

        fig, ax = plt.subplots(figsize=(10, 5))
        scatter    =    ax.scatter(X_pca[:,    0],    X_pca[:,    1],
c=data['cluster'], cmap='viridis')
        ax.set_title('KMeans Clustering Visualization')
        ax.set_xlabel('PCA Component 1')
        ax.set_ylabel('PCA Component 2')
        plt.colorbar(scatter, ax=ax, label='Cluster')
        st.pyplot(fig)

    return fig_elbow, fig_silhoute, fig, summary_table

def main():
    if 'logged_in' not in st.session_state:
        st.session_state['logged_in'] = False
    if 'role' not in st.session_state:
        st.session_state['role'] = None

    if not st.session_state['logged_in']:
        login()
    else:
        st.sidebar.title("Navigasi")
        page = st.sidebar.radio("Pilih Halaman", ["Data", "Time",
"Area", "Admin", "Log Out"])

        if page == "Admin" and st.session_state['role'] == "admin":
            st.title("User  Management")
            user_to_manage   =   st.selectbox("Pilih   User   untuk
Dikelola", ["upst", "psm"])
            action = st.selectbox("Pilih Aksi", ["Add User", "Edit
User", "Delete User"])
            if action == "Add User":
                new_username = st.text_input("Username")
                new_password      =      st.text_input("Password",
type="password")
                if st.button("Add User"):
                    if add_user(new_username, new_password):
                        st.success("User  berhasil ditambahkan!")
                    else:
                        st.error("User  sudah ada!")

            elif action == "Edit User":
                edit_username = user_to_manage
                new_password   =   st.text_input("New   Password",
type="password")
                if st.button("Edit User"):
                    if edit_user(edit_username, new_password):
                        st.success("User  berhasil diedit!")
                    else:
                        st.error("User  tidak ditemukan!")

            elif action == "Delete User":
delete_username = user_to_manage
                if st.button("Delete User"):
```

```
                    if delete_user(delete_username):
                        st.success("User  berhasil dihapus!")
                    else:
                        st.error("User  tidak ditemukan!")

        elif page == "Data":
            st.title("Data XLS")
            uploaded_file    =    st.file_uploader("Upload    XLS",
type="xlsx")

            if uploaded_file is not None:
                data = pd.read_excel(uploaded_file)
                df   =   data.applymap(lambda   x:   x.strip()   if
isinstance(x, str) else x)
                df   =   df.applymap(lambda   x:   x.capitalize()   if
isinstance(x, str) else x)
                df  =  df[['Kota  /  Kabupaten',  'Tahun',  'Bulan',
'Tonase']]
                df = df[(df['Kota / Kabupaten'].isna() == False) &
(df['Kota / Kabupaten'] != 'Lembaga')]
                df  =  df[(df['Tonase']  >=  100)  &  (df['Tonase']  <=
10000)]

                encoder = LabelEncoder()
                df['kota_kabupaten_code']                              =
encoder.fit_transform(df['Kota / Kabupaten'])
                df['tahun_code']                                       =
encoder.fit_transform(df['Tahun'])
                df['bulan_code']                                       =
encoder.fit_transform(df['Bulan'])

                save_data(collection_visualisasi, df)
                st.session_state['data_loaded'] = True
                st.subheader("Dataset Head")
                st.write(df.head())
                save_history(df.head(),
collection_name="visualisasi")

            total_rows                                                 =
collection_visualisasi.count_documents({})
            st.write(f"Total   data   saat   ini:   **{total_rows}
baris**")
            if st.button("Kosongkan Collection Visualisasi"):
                clear_collection(collection_visualisasi)
                st.rerun()

            st.title("Riwayat Visualisasi")
            history = load_history('visualisasi')
            if history.empty:
                st.warning("Belum ada riwayat visualisasi.")
            else:
                if st.button("Kosongkan Riwayat"):

delete_history_by_collection_name("visualisasi")
                    st.rerun()
```

```
                for index, row in history.iterrows():
                    st.write(f"{row['timestamp']}                -
{row['collection_name']}")
                    col1, col2 = st.columns([1, 1])
                    with col1:
                        if st.button(f"Lihat Hasil {row['_id']}"):
                            st.dataframe(row['data']['data_1'])
                    with col2:
                        if st.button(f"Hapus {row['_id']}"):
                            delete_history(row['_id'])
                            st.success(f"Riwayat      {row['_id']}
berhasil dihapus")
                            time.sleep(1)
                            st.rerun()

        elif page == "Time" and st.session_state['role'] == "user"
and st.session_state['username'] == "upst":
            if   'data'   not   in   st.session_state   or   not
st.session_state.get('data_loaded', False):
                data = load_data(collection_visualisasi)
                st.session_state['data'] = data
                st.session_state['data_loaded'] = True

            data = st.session_state['data'].copy()

            if st.button("Tampilkan Prediksi ARIMA"):
                plt = arima_prediction(data)
                save_history(plt, collection_name="arima")

            st.title("Riwayat Prediksi ARIMA")
            history = load_history('arima')
            if history.empty:
                st.warning("Belum ada riwayat prediksi.")
            else:
                if st.button("Kosongkan Riwayat"):
                    delete_history_by_collection_name("arima")
                    st.rerun()

                for index, row in history.iterrows():
                    st.write(f"{row['timestamp']}                -
{row['collection_name']}")
                    col1 = st.columns(1)  # Create one column
                    with col1[0]:  # Use the first (and only) column
                        if st.button(f"Lihat Hasil {row['_id']}"):
                            if 'fig_1' in row['data']:
fig_base64 = row['data']['fig_1']

show_image_from_history(fig_base64)

        elif page == "Area" and st.session_state['role'] == "user"
and st.session_state['username'] == "psm":
            if   'data'   not   in   st.session_state   or   not
st.session_state.get('data_loaded', False):
                data = load_data(collection_visualisasi)
```

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                st.session_state['data'] = data
                st.session_state['data_loaded'] = True

            data = st.session_state['data'].copy()

            if st.button("Tampilkan Prediksi KMeans"):
                fig_elbow, fig_silhoute, fig, cluster_summary =
kmeans_prediction(data)
                save_history(fig,     fig_elbow,     fig_silhoute,
cluster_summary, collection_name="kmeans")

            st.title("Riwayat Prediksi KMeans")
            history = load_history('kmeans')
            if history.empty:
                st.warning("Belum ada riwayat prediksi KMeans.")
            else:
                if st.button("Kosongkan Riwayat"):
                    delete_history_by_collection_name("kmeans")
                    st.rerun()

                for index, row in history.iterrows():
                    st.write(f"{row['timestamp']}                -
{row['collection_name']}")
                    col1, col2 = st.columns([1, 1])
                    with col1:
                        if st.button(f"Lihat Hasil {row['_id']}"):
                            if 'fig_1' in row['data']:
                                fig_base64 = row['data']['fig_1']

show_image_from_history(fig_base64)
                            if 'fig_2' in row['data']:
                                elbow_fig_base64                =
row['data']['fig_2']

show_image_from_history(elbow_fig_base64)
                            if 'fig_3' in row['data']:
                                elbow_fig_base64                =
row['data']['fig_3']

show_image_from_history(elbow_fig_base64)
                            if 'data_4' in row['data']:
                                df                              =
pd.DataFrame(row['data']['data_4'])
                                st.dataframe(df)
                    with col2:
                        if st.button(f"Hapus {row['_id']}"):
                            delete_history(row['_id'])
                            st.success(f"Riwayat      {row['_id']}
berhasil dihapus")
                            time.sleep(1)
                            st.rerun()

        elif page == "Log Out":
            st.session_state['logged_in'] = False
            st.session_state['role'] = None
```

```
            st.session_state['username'] = None
            st.rerun()

if name == "__main__":
    main()
```