BINAR

Covid-19 Dashboard And Customers Churn Analysis

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1. Business Understanding
2. Data Understanding (EDA)
3. Data Preparation
4. Modeling
5. Evaluation
6. Implementation

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Covid-19 Dashboard

https://datastudio.google.com/reporting/80d8cbfa-42a6-4e2a-977f-e41c4063b6f0

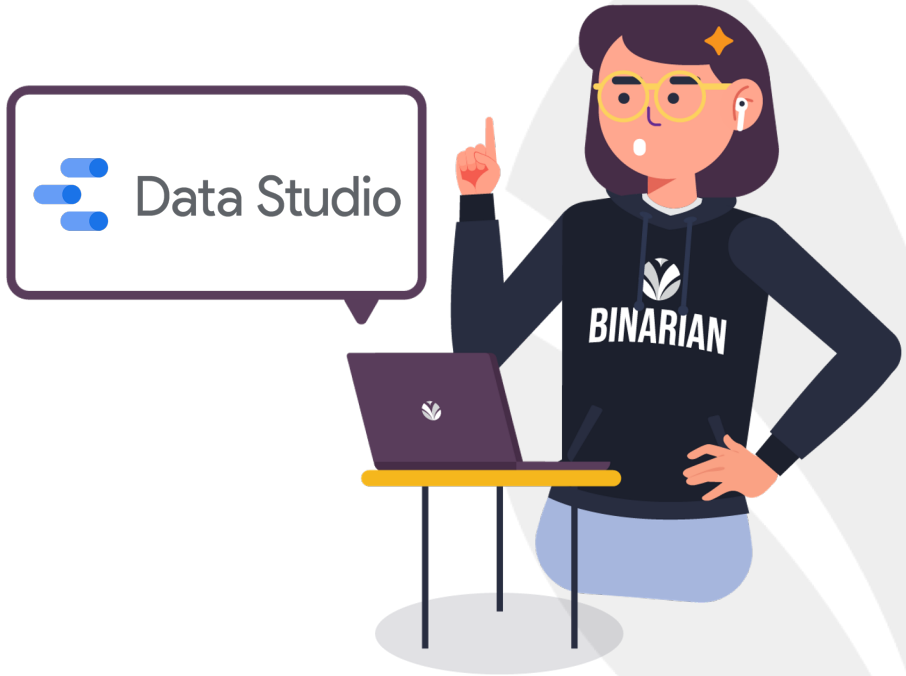
Pendahuluan

Pandemi Covid-19 telah melanda dunia sejak tahun 2020. Hingga sekarang, tren dari kasus covid di Indonesia sempat mengalami proses naik dan turun.

Dashboard yang dibuat ditujukan agar orang awam dapat mengetahui tren kasus covid yang ada di Indonesia sejak awal hingga saat ini.

Tools yang Digunakan

- Google Data Studio adalah BI tools yang dikelola oleh google
- Tools ini digunakan untuk membuat sebuah visualisasi data ke dalam bentuk report dan dashboard



Dashboard

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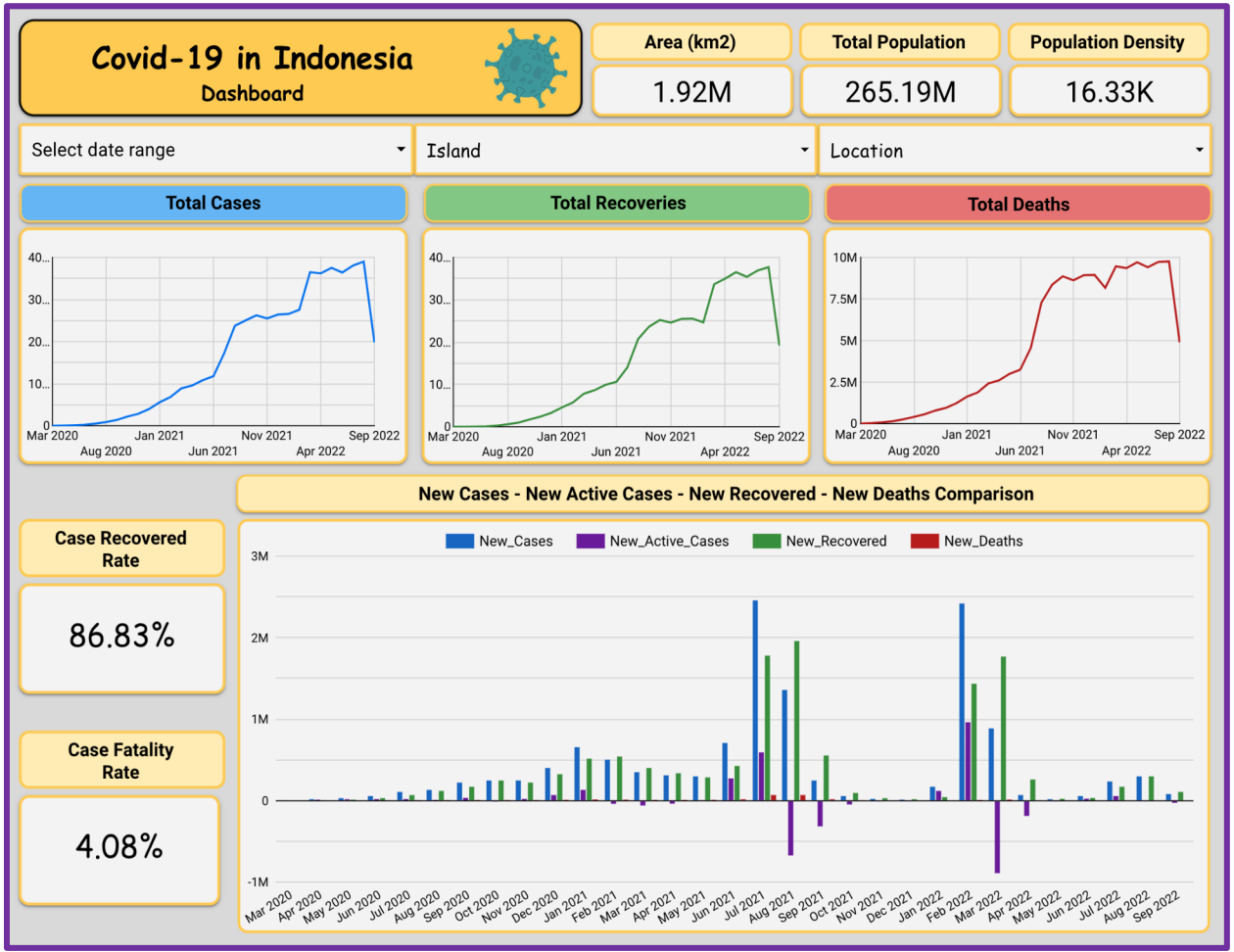
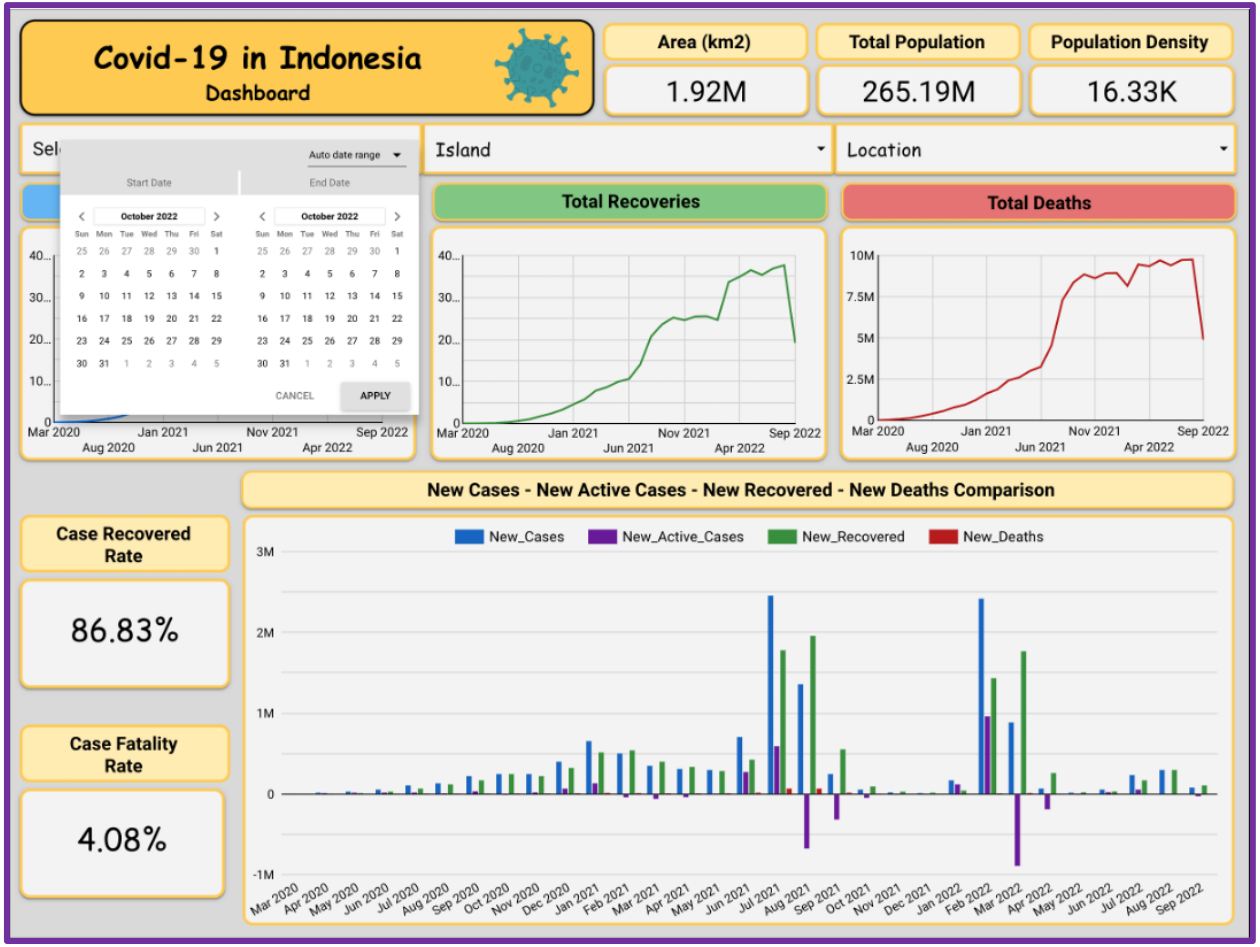
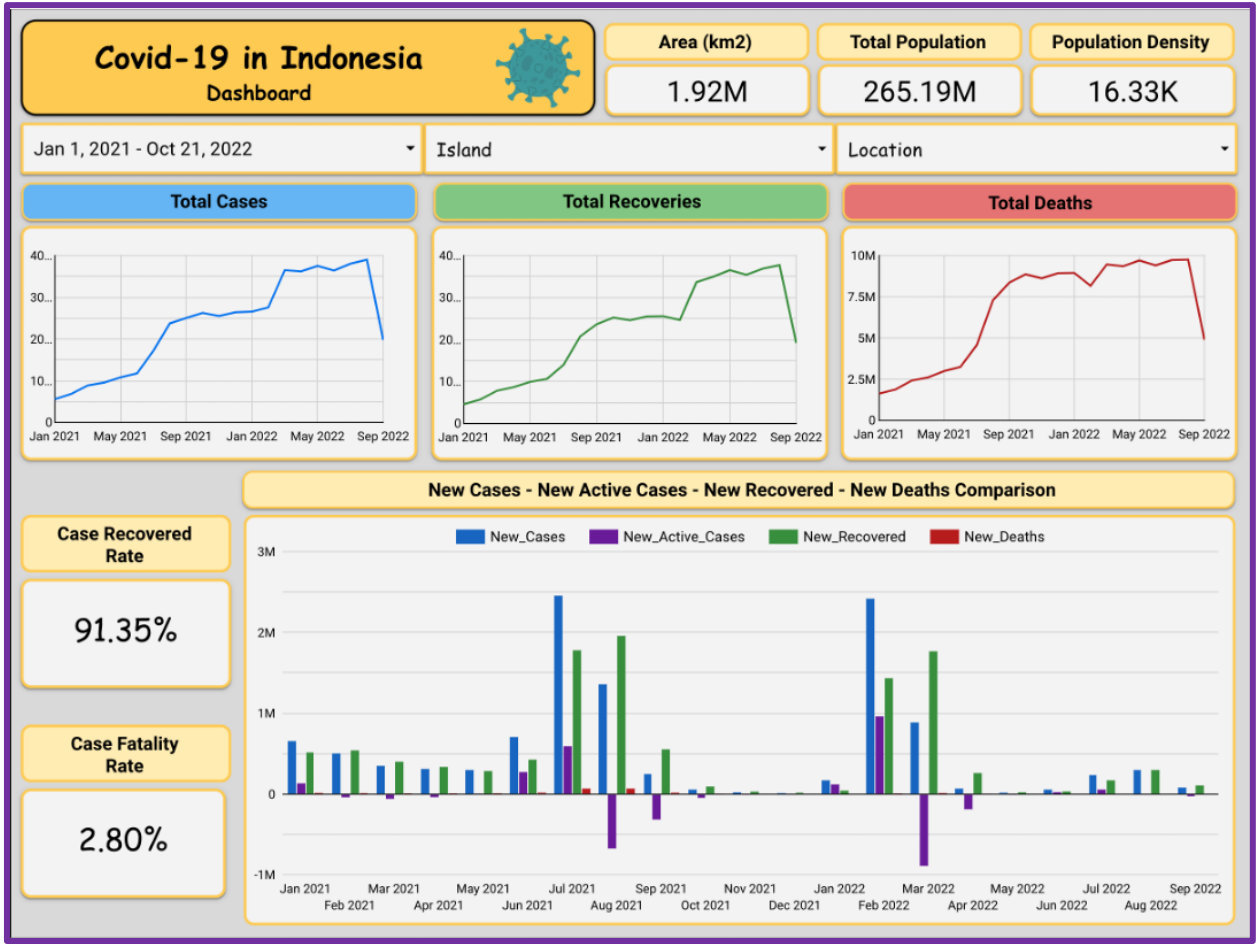


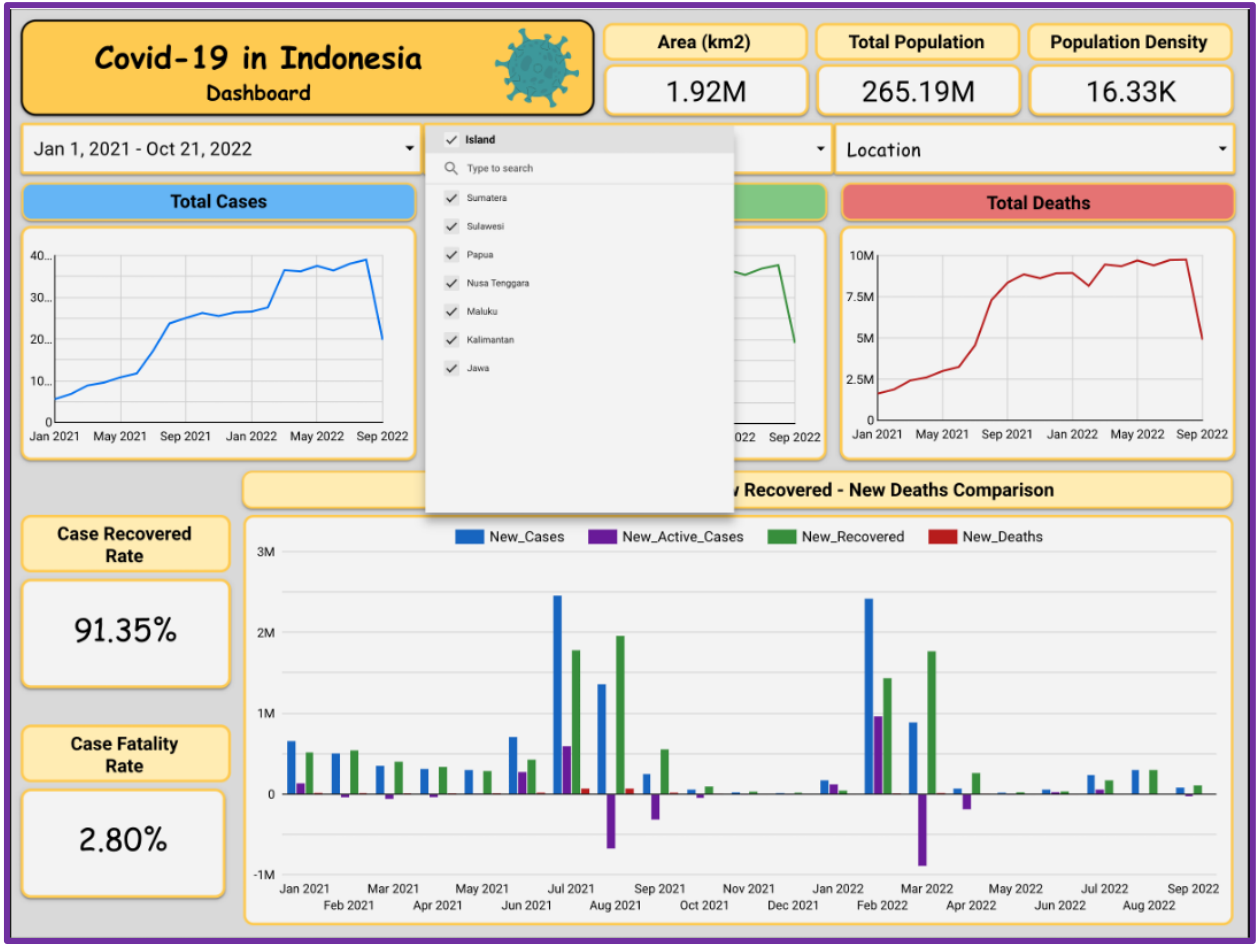
Dashboard Implement



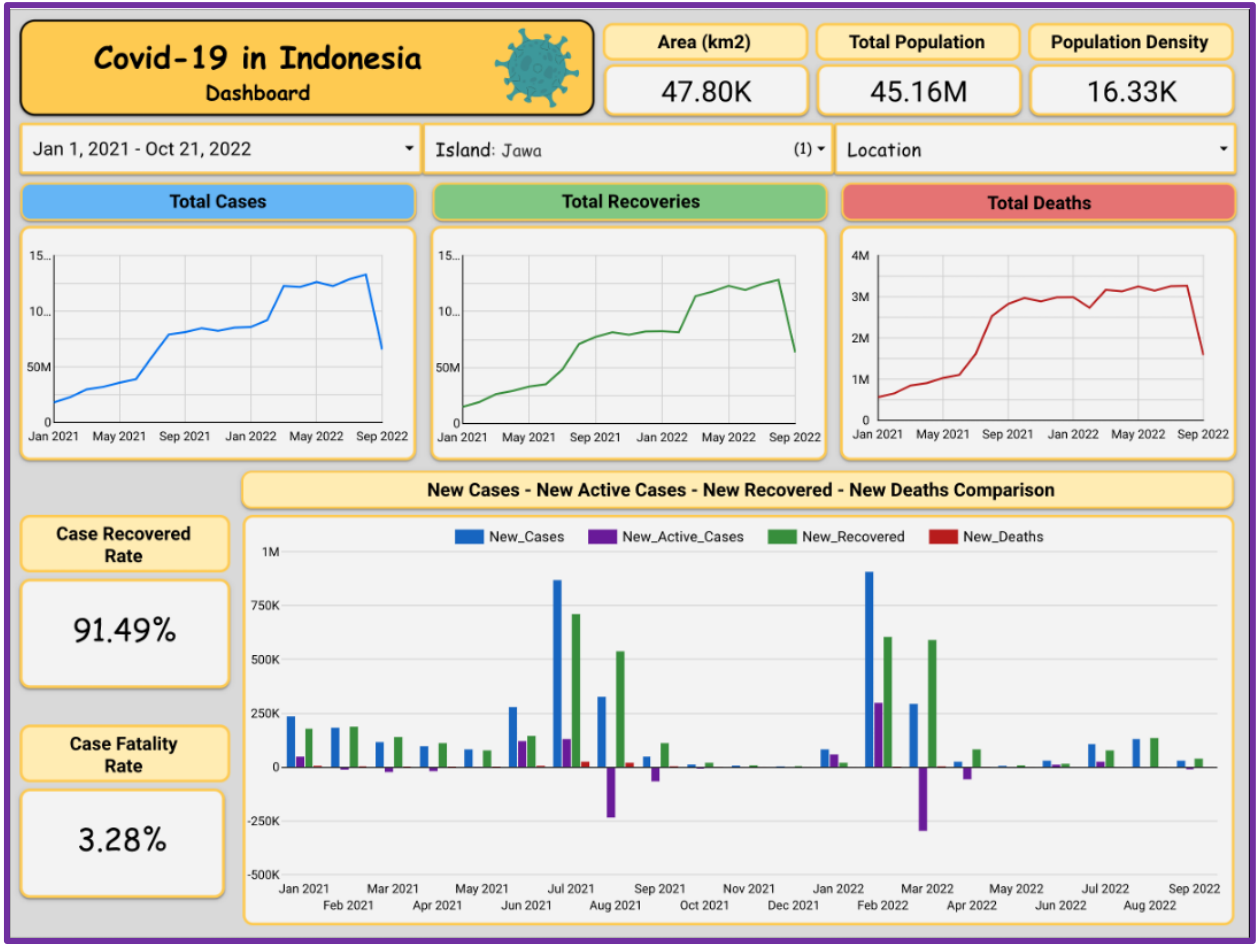
Dashboard Implement



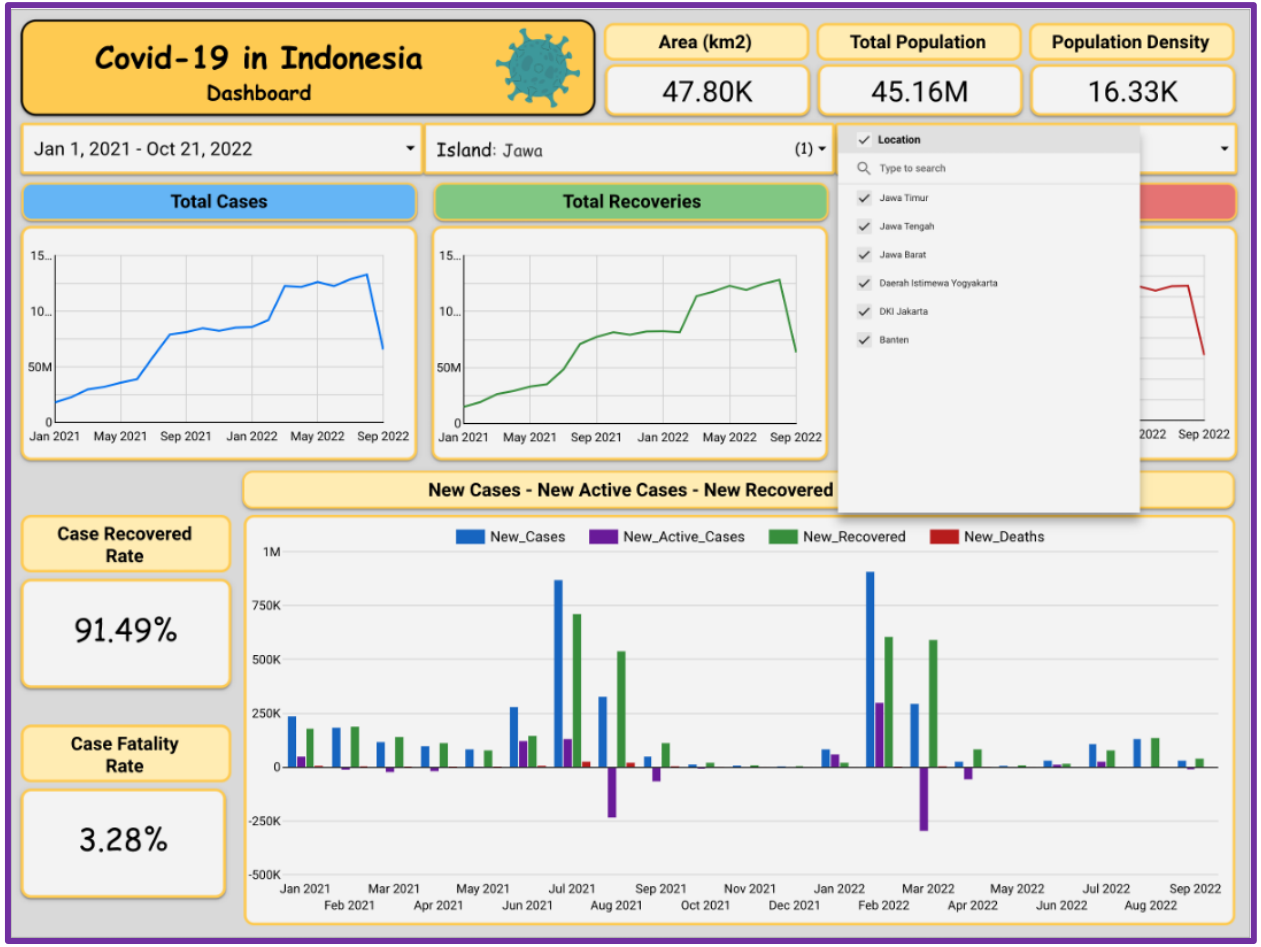
Dashboard Implement



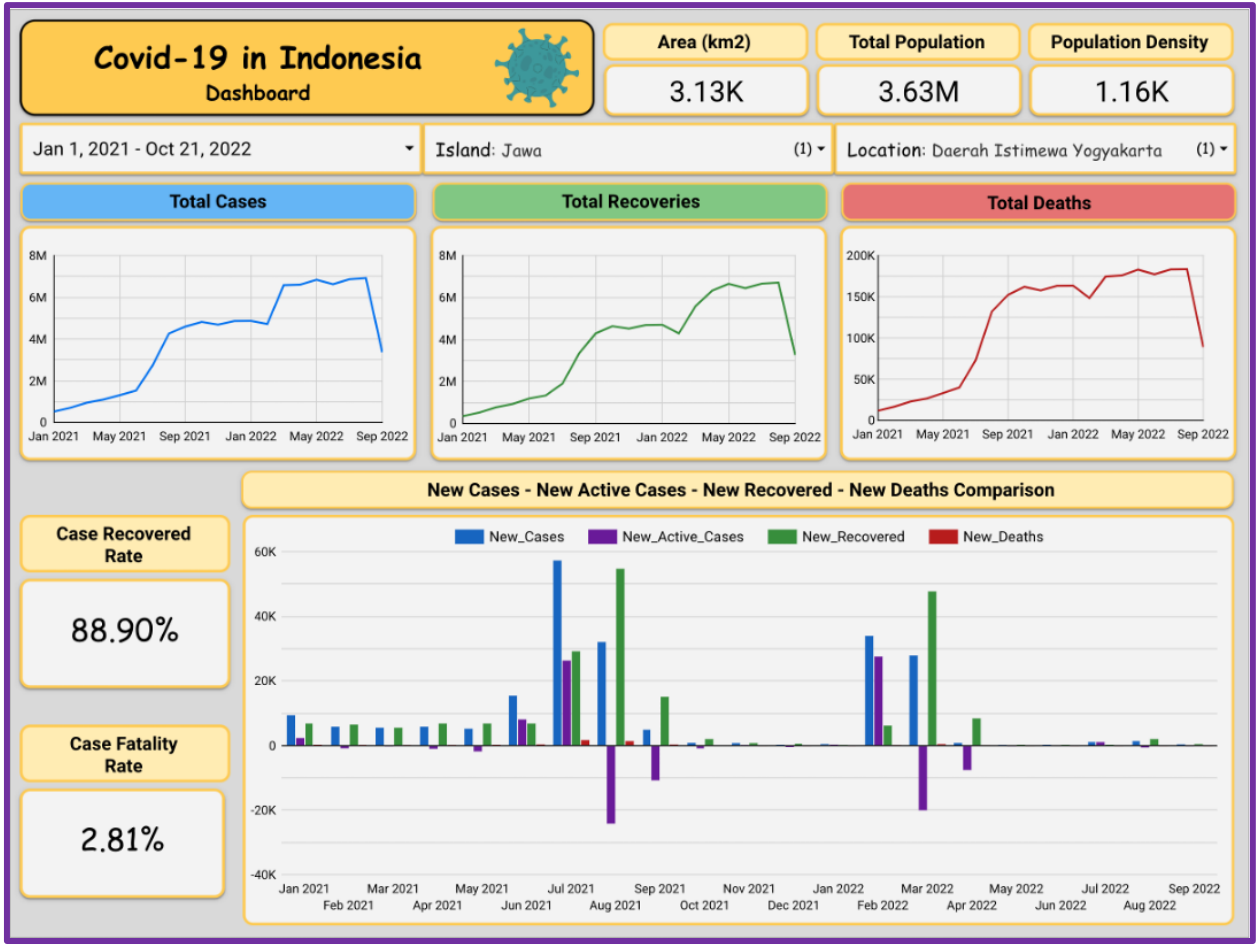
Dashboard Implement



Dashboard Implement



Dashboard Implement



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Customers Churn Analysis

https://www.kaggle.com/code/dewansm/customer-churn-prediction

Pendahuluan

Pada challenge ini, saya diberi tugas untuk membuat sebuah model untuk mengklasifikasi customer churn. Data yang diberikan pada challenge ini ada dua yaitu data train dan data test.

Customer Churn Analysis

Business Understanding

Merumuskan masalah bisnis dan mencari solusinya

Data Understanding

Melakukan *Exploratory Data Analysis (EDA)*

Data Preparation

Mempersiapkan data sebelum dijadikan fitur pelatihan model

Modeling

Membuat model *machine learning*

Evaluation

Melakukan evaluasi terhadap model-model yang dibuat

Implementation

Mengimplementasi model yang dibuat

Business Understanding

Problem and Solution

- Perkembangan industri telekomunikasi yang semakin cepat membuat setiap provider berlomba-lomba untuk memberikan fasilitas terbaiknya.
- Persaingan ini nantinya dapat menimbulkan seorang pelanggan berpindah dari salah satu provider telekomunikasi ke provider lain. Hal ini dapat disebut sebagai ***customer churn***.
- Pembuatan model machine learning untuk memprediksi apakah seorang pelanggan akan mengganti provider yang dia gunakan saat ini atau tidak.
- Nantinya, provider dapat memperkirakan fitur apa saja yang dapat mereka perbaiki atau tingkatkan untuk menjaga pelanggan mereka tetap menggunakan providernya.

Data Understanding (EDA)

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Data Train

- Dataset disamping adalah dataset train. Dataset ini terdiri dari 4250 baris dan 20 kolom.
- Komposisi dari dataset ini mulai dari total null value hingga jumlah unique valuenya dapat dilihat pada gambar disamping
- Selain itu, dataset ini tidak memiliki baris yang terduplikasi, sehingga dataset ini dapat dikatakan cukup bersih.

	Total_Null	Percentage_Null	Unique_Value
state	0	0.0%	51
account_length	0	0.0%	215
area_code	0	0.0%	3
international_plan	0	0.0%	2
voice_mail_plan	0	0.0%	2
number_vmail_messages	0	0.0%	46
total_day_minutes	0	0.0%	1843
total_day_calls	0	0.0%	120
total_day_charge	0	0.0%	1843
total_eve_minutes	0	0.0%	1773
total_eve_calls	0	0.0%	123
total_eve_charge	0	0.0%	1572
total_night_minutes	0	0.0%	1757
total_night_calls	0	0.0%	128
total_night_charge	0	0.0%	992
total_intl_minutes	0	0.0%	168
total_intl_calls	0	0.0%	21
total_intl_charge	0	0.0%	168
number_customer_service_calls	0	0.0%	10
churn	0	0.0%	2

Customer Churn Analysis

	Total_Null	Percentage_Null	Unique_Value
id	0	0.0%	750
state	0	0.0%	51
account_length	0	0.0%	175
area_code	0	0.0%	3
international_plan	0	0.0%	2
voice_mail_plan	0	0.0%	2
number_vmail_messages	0	0.0%	39
total_day_minutes	0	0.0%	619
total_day_calls	0	0.0%	100
total_day_charge	0	0.0%	619
total_eve_minutes	0	0.0%	611
total_eve_calls	0	0.0%	102
total_eve_charge	0	0.0%	584
total_night_minutes	0	0.0%	628
total_night_calls	0	0.0%	97
total_night_charge	0	0.0%	502
total_intl_minutes	0	0.0%	135
total_intl_calls	0	0.0%	17
total_intl_charge	0	0.0%	135
number_customer_service_calls	0	0.0%	7

Data Test

- Dataset disamping adalah dataset test. Dataset ini terdiri dari 750 baris dan 19 kolom. Perbedaan dataset train dan test adalah kolom customer churn pada dataset ini tidak ada

- Dataset ini tidak memiliki nilai null dan duplikat. Untuk pesebaran dataset ini dapat dilihat pada gambar di samping.

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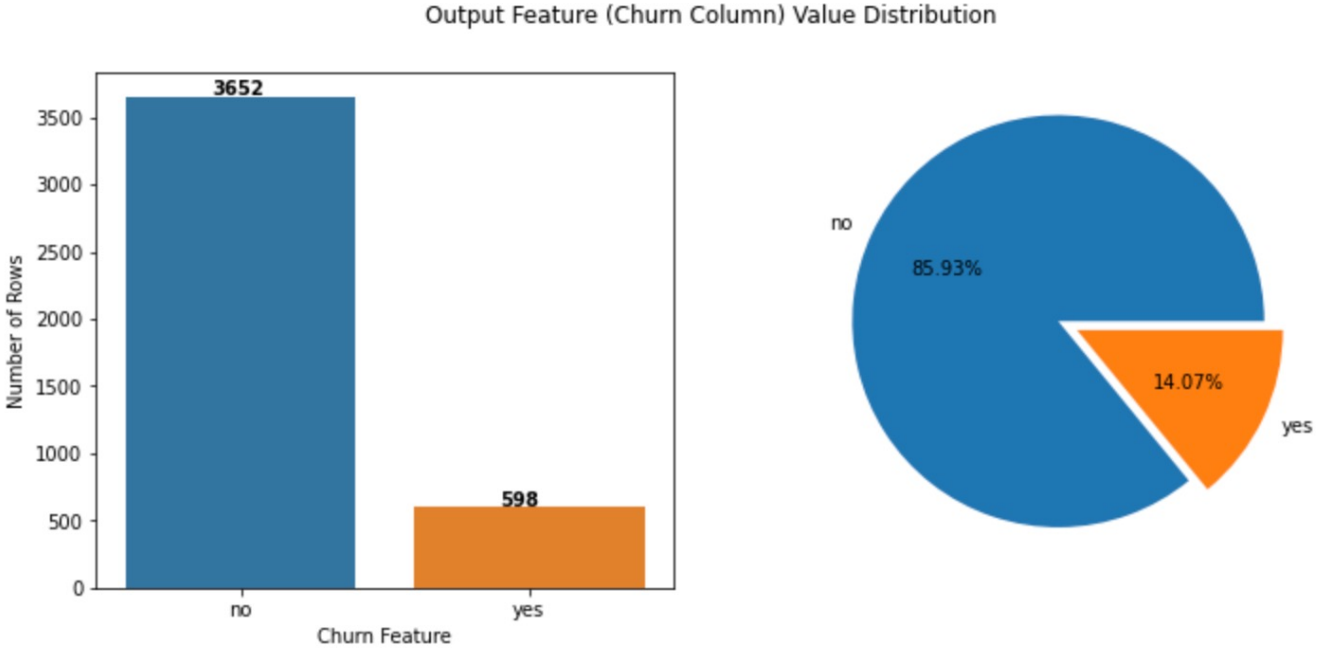
Kolom Output



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Kolom State dan Area_Code

state	yes_churn			no_churn		
	area_code_408	area_code_415	area_code_510	area_code_408	area_code_415	area_code_510
AK	12	31	18	12	31	18
AL	30	54	17	30	54	17
AR	20	38	13	20	38	13
AZ	19	43	15	19	43	15
CA	10	19	10	10	19	10
CO	28	37	15	28	37	15
CT	24	43	21	24	43	21
DC	14	40	18	14	40	18
DE	15	45	20	15	45	20
FL	22	34	20	22	34	20
GA	22	25	17	22	25	17
HI	21	37	19	21	37	19
IA	15	24	23	15	24	23
ID	21	59	26	21	59	26
IL	21	41	17	21	41	17
IN	18	43	22	18	43	22
KS	18	45	24	18	45	24
KY	22	46	17	22	46	17
LA	21	34	14	21	34	14
MA	36	38	15	36	38	15
MD	21	45	20	21	45	20
ME	20	36	33	20	36	33
MI	17	47	23	17	47	23
MN	31	51	26	31	51	26
MO	21	40	19	21	40	19
MS	18	41	23	18	41	23
MT	17	42	21	17	42	21
NC	29	32	19	29	32	19
ND	18	30	19	18	30	19
NE	13	43	17	13	43	17
NH	26	32	20	26	32	20
NJ	20	49	27	20	49	27
NM	25	40	13	25	40	13
NV	21	41	21	21	41	21
NY	24	51	21	24	51	21
OH	27	46	22	27	46	22
OK	25	29	24	25	29	24
OR	24	56	19	24	56	19
PA	18	32	17	18	32	17
RI	16	43	28	16	43	28
SC	17	35	20	17	35	20
SD	19	35	21	19	35	21
TN	15	42	22	15	42	22
TX	24	53	21	24	53	21
UT	18	49	30	18	49	30
VA	28	54	18	28	54	18
VT	16	47	23	16	47	23
WA	26	33	21	26	33	21
WI	25	44	25	25	44	25
WV	34	62	43	34	62	43
WY	24	52	19	24	52	19

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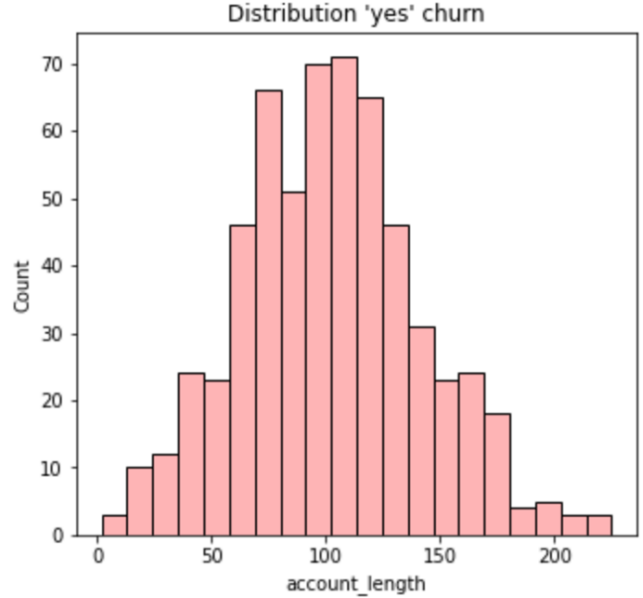
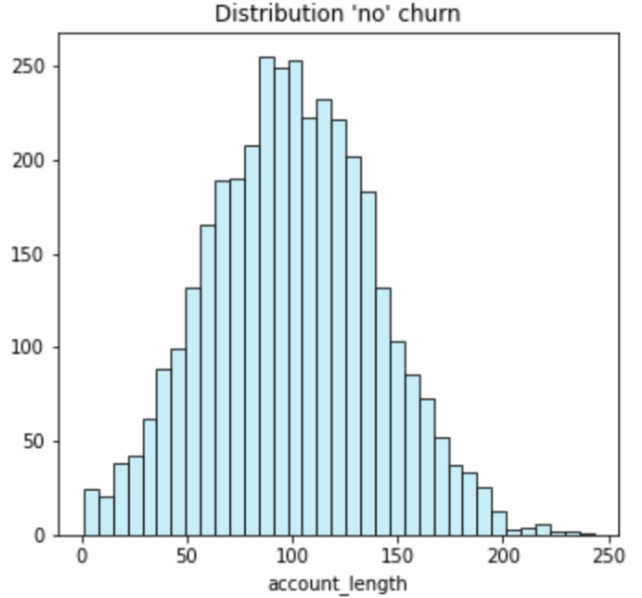
Kolom Account_Length





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Kolom Number_Customer_Service_Calls

number_customer_service_calls	no	yes
0	789	97
1	1358	166
2	845	102
3	495	63
4	117	92
5	32	49
6	9	19
7	6	7
8	1	1
9	0	2

- Secara persentase terhadap jumlah data per kolom customer churn, customer churn ‘yes’ cenderung lebih banyak menelpon customer service selama berlanggan dibandingkan customer churn ‘no’.
- Di sisi lain, terdapat data yang memiliki nilai tinggi (jumlah telfon ≥ 8) namun hanya berjumlah sedikit

Data Preparation

```
df_train.drop(df_train[df_train['number_customer_service_calls'] >= 8].index, inplace=True)
```

Menghapus baris data pelanggan yang menelfon customer service lebih atau sama dengan 8x

```
del_idx = [ x for x in df_bill[(df_bill['day_ratio'] < .5) |
                               (df_bill['eve_ratio'] < .5) |
                               (df_bill['night_ratio'] < .5) |
                               (df_bill['intl_ratio'] < .5)
                              ]
           [[x for x in cols]].index
          ]

df_train.drop(index=[x for x in del_idx], inplace=True)
```

Menghapus baris data pelanggan yang memiliki rata-rata waktu saat menelfon kurang dari 0.5 menit atau 30 detik

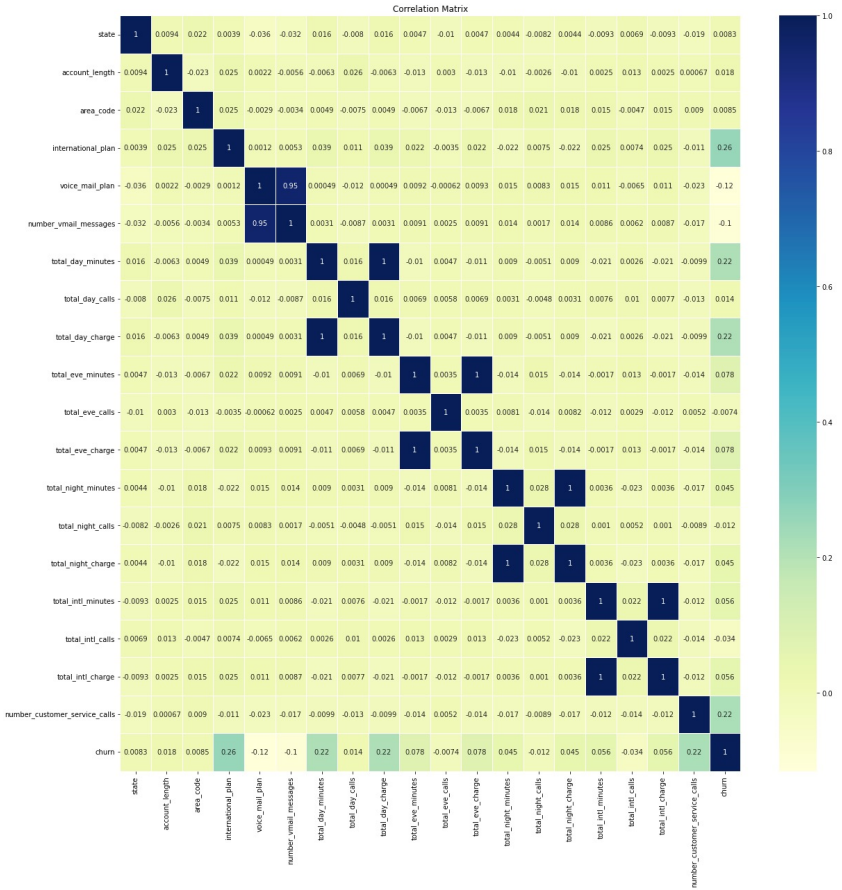
Encoding Data

- Membuat data categorical menjadi data numerik. Hal ini dilakukan agar kolom categorical dapat dijadikan fitur untuk mentraining data. Selain itu, hal ini dilakukan agar dapat dibuat sebuah visualisasi yang memperlihatkan korelasi antar fitur.

```
le = LabelEncoder()

for col in df_train.columns:
    if df_train[col].dtype == 'O':
        df_train[col] = le.fit_transform(df_train[col])
```

Customer Churn Analysis



Features Selection

Fitur yang dipilih adalah:

1. 'account_length',
2. 'area_code',
3. 'international_plan',
4. 'total_day_minutes',
5. 'total_day_calls',
6. 'total_eve_minutes',
7. 'total_eve_calls',
8. 'total_night_minutes',
9. 'total_night_calls',
10. 'total_intl_minutes',
11. 'total_intl_calls', dan
12. 'number_customer_service_calls'

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Splitting and Features Scaling

- Membagi data menjadi data train (80%) dan data test (20%)

```
X_train, X_test, y_train, y_test = train_test_split(X, y, train_size=.8, random_state=123)

print('x train dimension : {}'.format(X_train.shape))
print('x test dimension : {}'.format(X_test.shape))
print()
print('y train dimension : {}'.format(y_train.shape))
print('y test dimension : {}'.format(y_test.shape))
```

```
x train dimension : (3355, 12)
x test dimension : (839, 12)

y train dimension : (3355,)
y test dimension : (839,)
```

- Menscaling data menggunakan Standarisasi

```
stand = StandardScaler()

X_train = stand.fit_transform(X_train)
X_test = stand.transform(X_test)
```

Modeling

Customer Churn Analysis

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XGBoost Algorithm

```
# Fit and train the model
xgb_model = XGBClassifier()
xgb_model.fit(X_train,y_train)
xgb_predict = xgb_model.predict(X_test)
```

Naïve Bayes Algorithm

```
# Fit and train the model
nb_model = GaussianNB()
nb_model.fit(X_train, y_train)
nb_predict = nb_model.predict(X_test)
```

SVM Algorithm

```
# Fit and train the model
svm_model = SVC()
svm_model.fit(X_train,y_train)
svm_predict = svm_model.predict(X_test)
```

K-Nearest Neighbor Algorithm

```
# Fit and train the model
knn_model = KNeighborsClassifier()
knn_model.fit(X_train, y_train)
knn_predict = knn_model.predict(X_test)
```

Logistic Algorithm

```
# Fit and train the model
lr_model = LogisticRegression()
lr_model.fit(X_train, y_train)
lr_predict = lr_model.predict(X_test)
```

LDA Algorithm

```
# Fit and train the model
lda_model = LinearDiscriminantAnalysis()
lda_model.fit(X_train, y_train)
lda_predict = lda_model.predict(X_test)
```

Decision Tree Algorithm

```
# Fit and train the model
dtc_model = DecisionTreeClassifier()
dtc_model.fit(X_train, y_train)
dtc_predict = dtc_model.predict(X_test)
```

Evaluation

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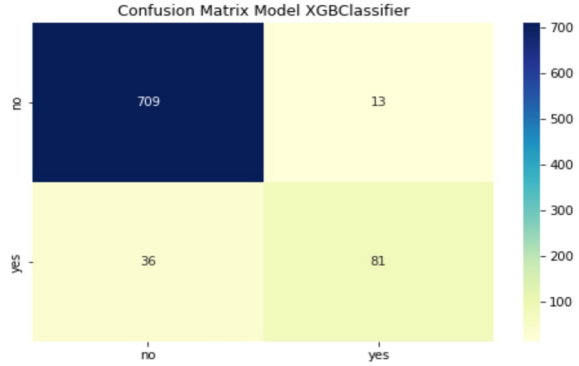
```python
# This function is for showing the evaluation metrics for the trained model and its confusion matrix
def eval_model(model, y_test, y_predict):

    print(metrics.classification_report(y_test, y_predict))
    print()
    fig, ax = plt.subplots(figsize=(8,5))
    sns.heatmap(metrics.confusion_matrix(y_test, y_predict), annot=True, cmap="YlGnBu", fmt='g', ax=ax)
    ax.set_title('Confusion Matrix Model {}'.format(model.__class__.__name__))
    ax.xaxis.set_ticklabels(['no', 'yes'])
    ax.yaxis.set_ticklabels(['no', 'yes'])
```

```
              precision    recall  f1-score   support

           0       0.95      0.98      0.97       722
           1       0.86      0.69      0.77       117

    accuracy                           0.94       839
   macro avg       0.91      0.84      0.87       839
weighted avg       0.94      0.94      0.94       839
```



Untuk melakukan evaluasi individu per model, saya membuat sebuah fungsi bernama **'eval_model'**.

Fungsi ini digunakan untuk menampilkan beberapa skor metrik dari model dan confusion matrix.

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Evaluation

- Saya melakukan evaluasi model berdasarkan beberapa metrik seperti akurasi, presisi, recall, skor f1 dan AUC. Visualisasi dari model ini dapat dilihat pada gambar di bawah.
- Berdasarkan visualisasi tersebut, didapat jika model terbaik adalah model yang dilatih dengan menggunakan algoritma XGBoost dengan nilai skor dari setiap metriknya termasuk ke dalam skor tertinggi.

	accuracy	precision_no	precision_yes	recall_no	recall_yes	f1_no	f1_yes	roc_auc
XGBoost	0.941597	0.951678	0.861702	0.981994	0.692308	0.966599	0.767773	0.837151
Support_Vector_Machine	0.902265	0.912371	0.777778	0.980609	0.418803	0.945260	0.544444	0.699706
Logistic	0.866508	0.880299	0.567568	0.977839	0.179487	0.926509	0.272727	0.578663
Decision_Tree	0.898689	0.945455	0.629032	0.936288	0.666667	0.940849	0.647303	0.801477
Naive_Bayes	0.851013	0.901750	0.458333	0.927978	0.376068	0.914676	0.413146	0.652023
KNN	0.873659	0.883085	0.657143	0.983380	0.196581	0.930537	0.302632	0.589980
Linear_Discriminant_Analysis	0.855781	0.882803	0.462963	0.959834	0.213675	0.919708	0.292398	0.586755

Implementation

Implementation

- Untuk menggunakan model, saya membuat sebuah fungsi bernama **‘use_model’**. Fungsi ini nantinya dapat digunakan untuk melakukan prediksi data baru berdasarkan model XGBoost yang telah saya buat sebelumnya.

- Fungsi ini nantinya akan secara otomatis mengambil fitur yang diperlukan, melabel kolom categorical, melakukan standarisasi data, dan mengimplementasikan model XGBoost.

```
def use_model(df, label_encoder, standarization):
    features = ['account_length', 'area_code', 'international_plan', 'total_day_minutes', 'total_day_calls', '

    X = df.loc[:,[x for x in features]]
    for col in X.columns:
        if X[col].dtype == 'O':
            X[col] = label_encoder.fit_transform(X[col])
    X = standarization.transform(X)
    df['churn'] = nb_model.predict(X)
    return df
```

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Implementation

- Selanjutnya saya menggunakan fungsi model tadi dengan input berupa dataset test. Hasil dari fungsi ini dapat dilihat dibawah ini.

- Saya juga menyimpan dataset baru yang sudah diprediksi customer churnnya dengan nama ‘customer_churn_predict.csv’.

```
output = use_model(df_test, le, stand)
print('Predicted column distribution:\n{}'.format(output['churn'].value_counts()))
print()
output
```

```
Predicted column distribution:
0    654
1     96
Name: churn, dtype: int64
```

	id	state	account_length	area_code	international_plan	voice_mail_plan	number_vmail_messages	total_day_minutes	total_day_calls
0	1	KS	128	area_code_415	no	yes	25	265.1	110
1	2	AL	118	area_code_510	yes	no	0	223.4	98
2	3	IA	62	area_code_415	no	no	0	120.7	70
3	4	VT	93	area_code_510	no	no	0	190.7	114
4	5	NE	174	area_code_415	no	no	0	124.3	76
...	...	...	...	...	...	...	...	...	...
745	746	GA	130	area_code_415	no	no	0	119.4	99
746	747	WA	73	area_code_408	no	no	0	177.2	118
747	748	WV	152	area_code_415	no	no	0	184.2	90
748	749	DC	61	area_code_415	no	no	0	140.6	89
749	750	DC	109	area_code_510	no	no	0	188.8	67

750 rows × 21 columns

Terima Kasih

AFTER SLIDES

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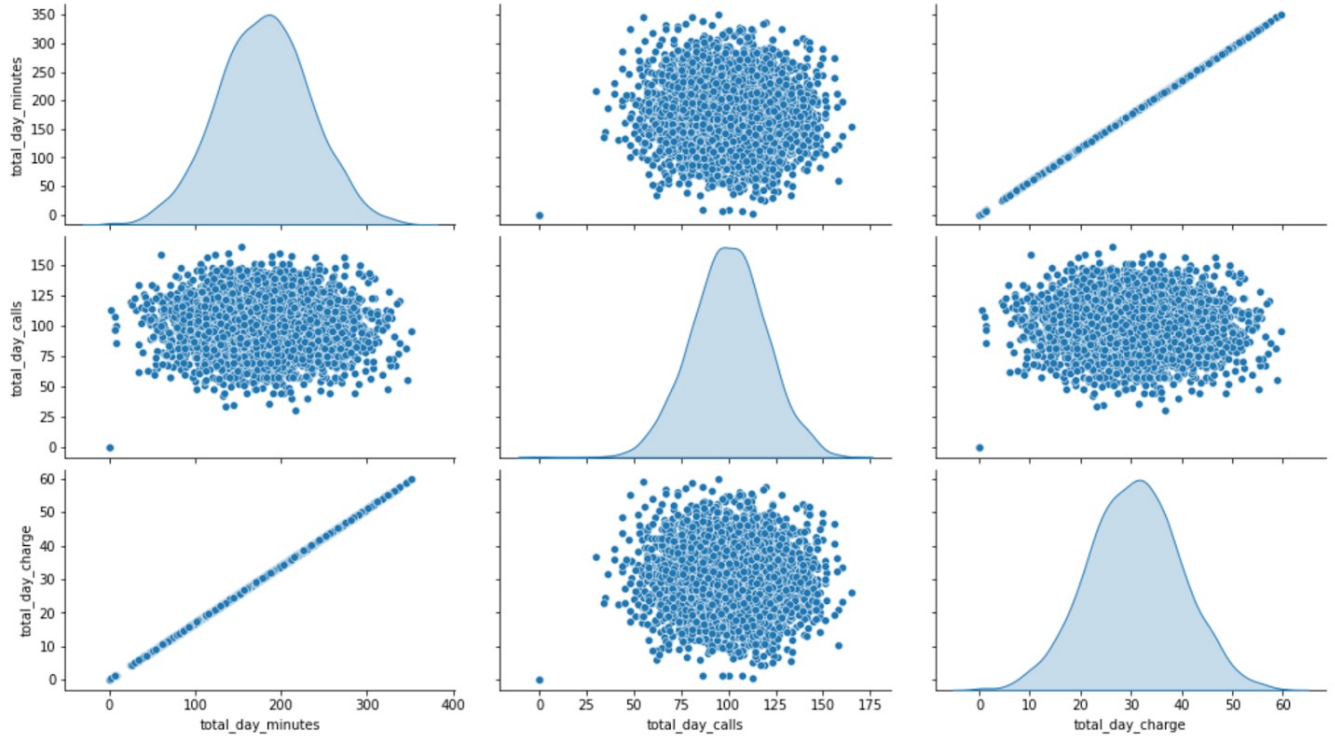
Kolom Total Day_



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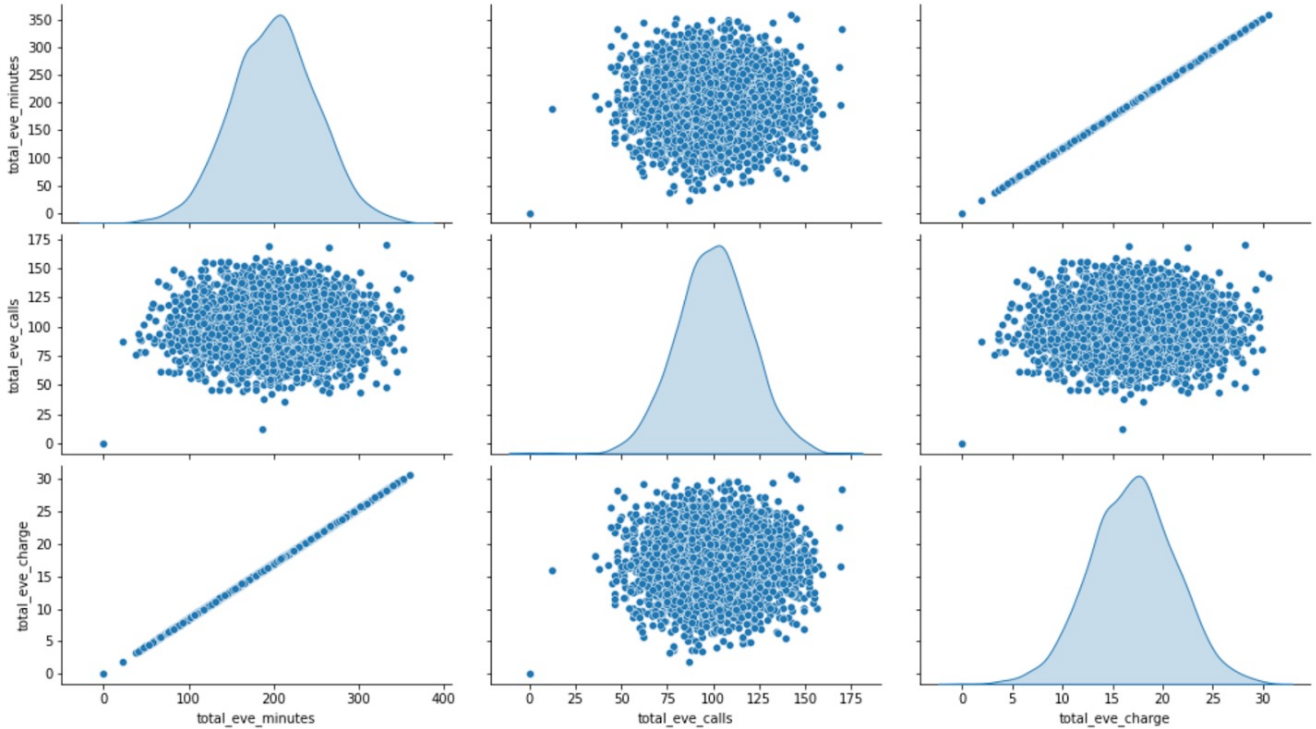
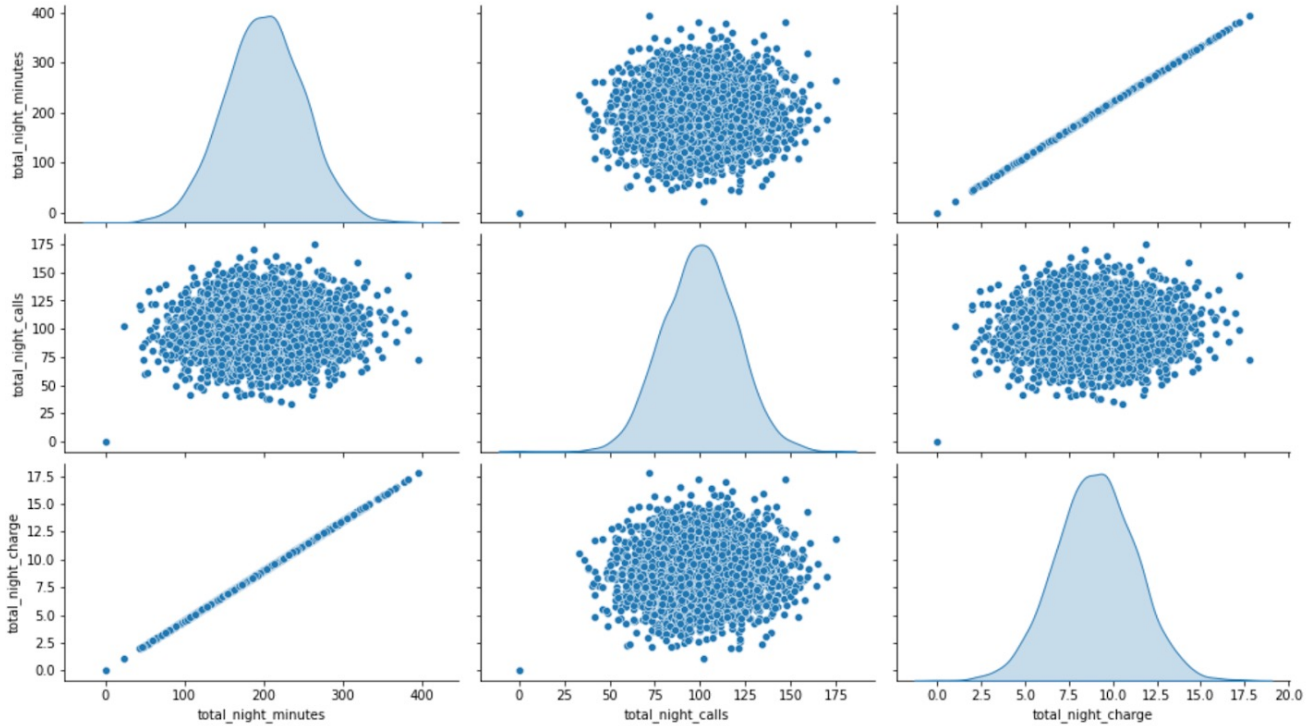
Kolom Total Evening_



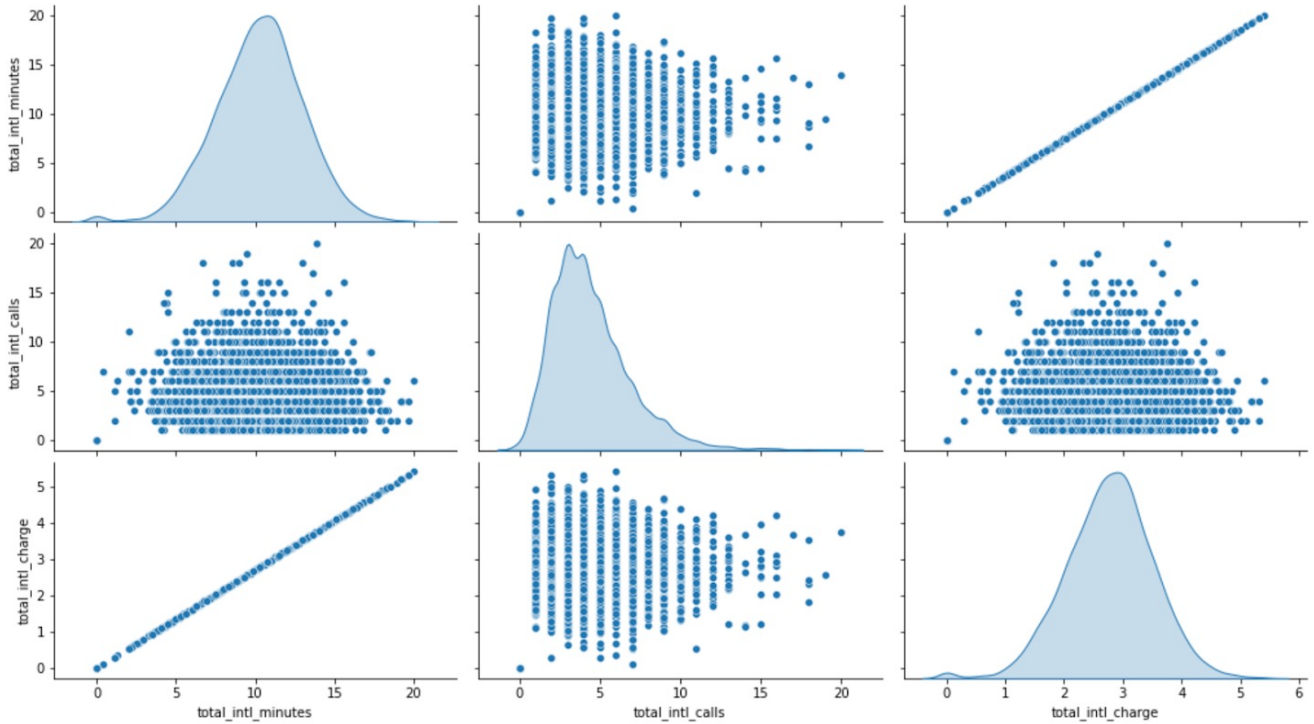
BINAR

Kolom Total Night_



BINAR

Kolom Total Intl_



BINAR

Cleaning

```
df_bill = (df_train
             .assign(day_ratio = lambda df_: df_.total_day_minutes / df_.total_day_calls,
                     eve_ratio = lambda df_: df_.total_eve_minutes / df_.total_eve_calls,
                     night_ratio = lambda df_: df_.total_night_minutes / df_.total_night_calls,
                     intl_ratio = lambda df_: df_.total_intl_minutes / df_.total_intl_charge,
                    )
          )

cols = ['total_day_minutes', 'total_day_calls', 'total_day_charge', 'total_day_charge', 'total_eve_minutes', '
df_bill[(df_bill['day_ratio'] < .5) |
        (df_bill['eve_ratio'] < .5) |
        (df_bill['night_ratio'] < .5) |
        (df_bill['intl_ratio'] < .5)
       ][[x for x in cols]].sample(5)
```

utes	total_night_calls	total_night_charge	total_intl_minutes	total_intl_calls	total_intl_charge	day_ratio	eve_ratio	night_ratio	intl_ratio	churn
152.9	94	6.88	9.8	6	2.65	0.416667	2.044595	1.626596	3.698113	no
228.1	64	10.26	6.5	7	1.76	0.217647	2.151042	3.564062	3.693182	no
23.2	102	1.04	9.5	4	2.57	1.496262	1.240441	0.227451	3.696498	no
227.5	118	10.24	10.4	4	2.81	0.484112	2.213462	1.927966	3.701068	no
325.9	105	14.67	8.6	6	2.32	0.243089	1.103419	3.103810	3.706897	no