Session 40

Model Deployment II

Table of Content

What will We Learn Today?

1. Integrating ML model into web application
2. Deploy ML model on PythonAnywhere
3. Deploy ML model on Heroku

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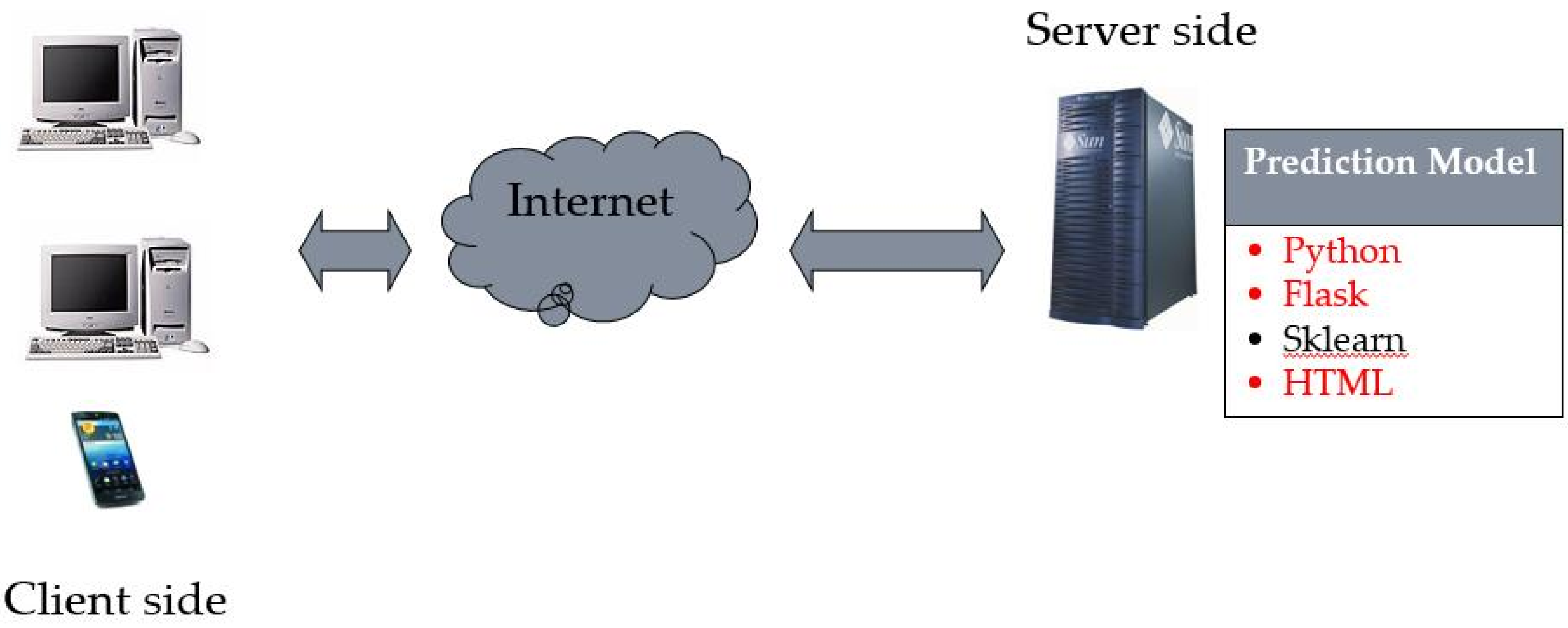
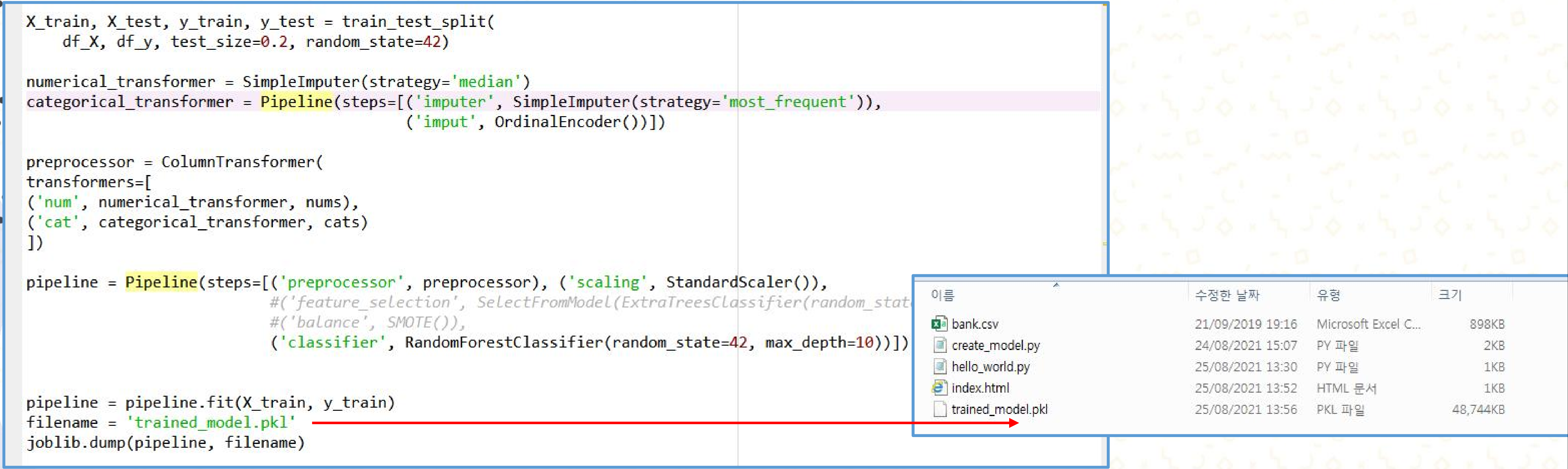
Integrating ML model into web app

Proposed system



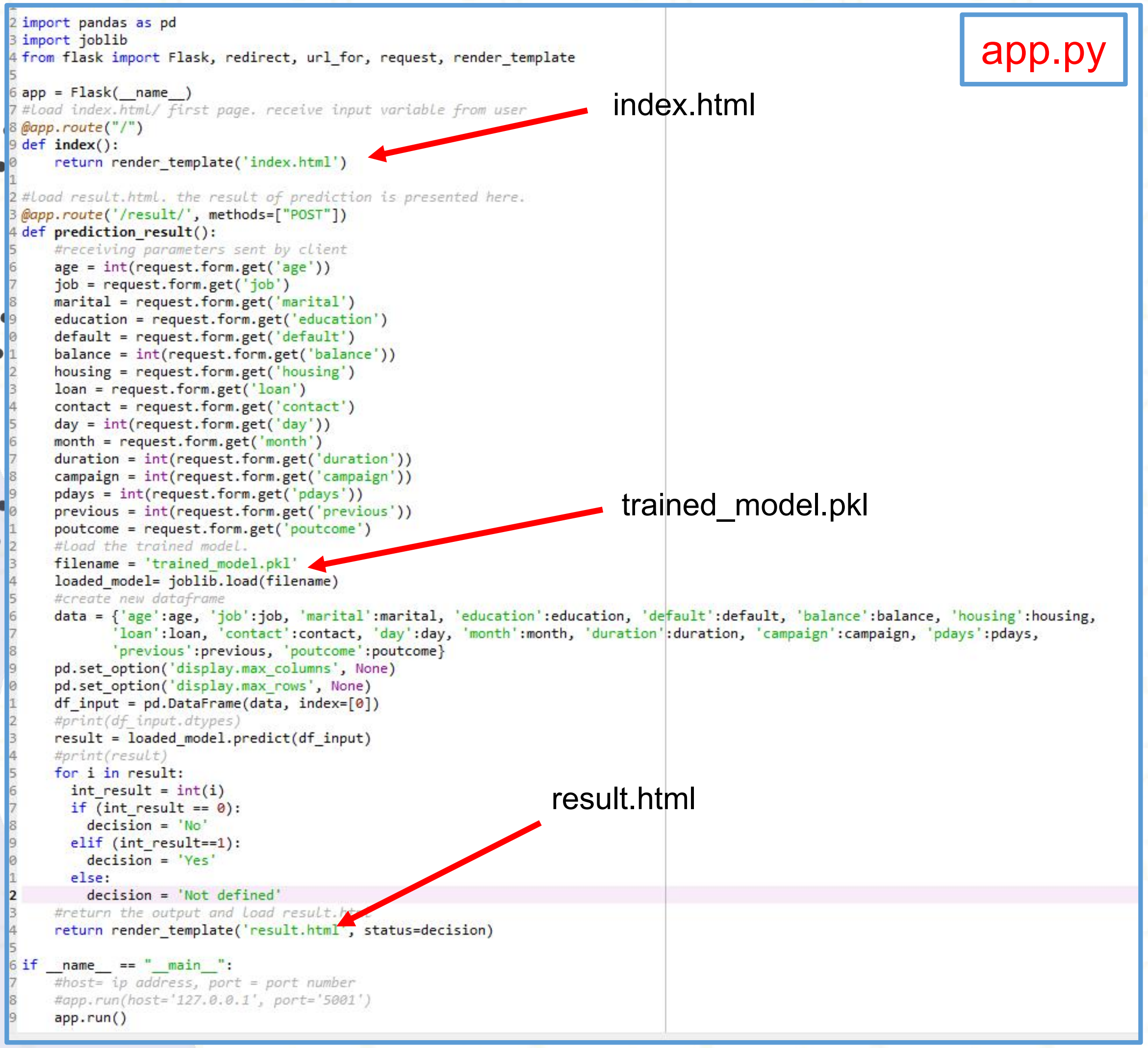
Save trained model into file



```
X_train, X_test, y_train, y_test = train_test_split(
    df_X, df_y, test_size=0.2, random_state=42)

numerical_transformer = SimpleImputer(strategy='median')
categorical_transformer = Pipeline(steps=[('imputer', SimpleImputer(strategy='most_frequent')),
                                          ('imput', OrdinalEncoder())])

preprocessor = ColumnTransformer(
transformers=[
('num', numerical_transformer, nums),
('cat', categorical_transformer, cats)
])

pipeline = Pipeline(steps=[('preprocessor', preprocessor), ('scaling', StandardScaler()),
                           #('feature_selection', SelectFromModel(ExtraTreesClassifier(random_stat
                           #('balance', SMOTE()),
                           ('classifier', RandomForestClassifier(random_state=42, max_depth=10))])


pipeline = pipeline.fit(X_train, y_train)
filename = 'trained_model.pkl'
joblib.dump(pipeline, filename)
```

이름	수정한 날짜	유형	크기
bank.csv	21/09/2019 19:16	Microsoft Excel C...	898KB
create_model.py	24/08/2021 15:07	PY 파일	2KB
hello_world.py	25/08/2021 13:30	PY 파일	1KB
index.html	25/08/2021 13:52	HTML 문서	1KB
trained_model.pkl	25/08/2021 13:56	PKL 파일	48,744KB

Web app (backend)



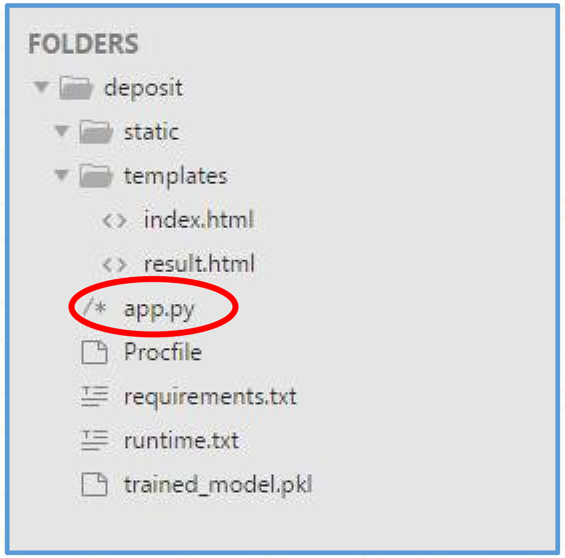
app.py

index.html

trained_model.pkl

result.html

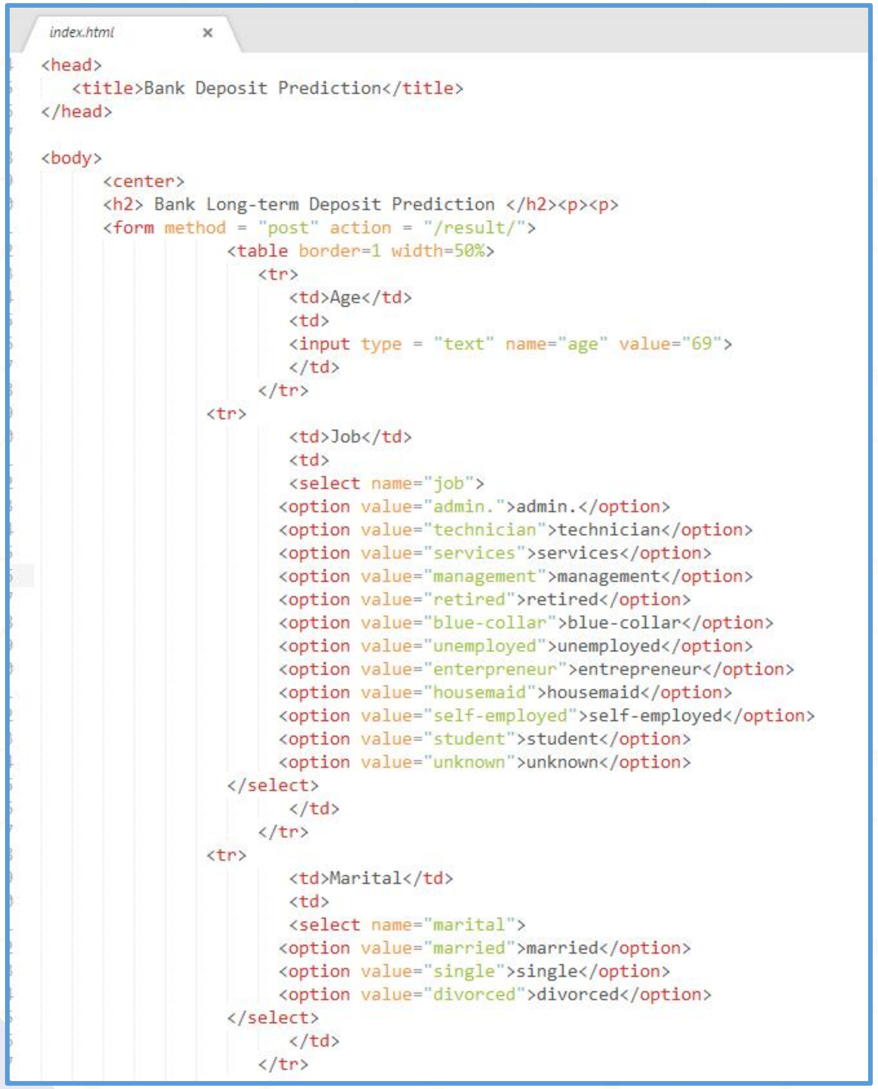
```python
import pandas as pd
import joblib
from flask import Flask, redirect, url_for, request, render_template

app = Flask(__name__)
#load index.html/ first page. receive input variable from user
@app.route("/")
def index():
    return render_template('index.html')

#load result.html. the result of prediction is presented here.
@app.route('/result/', methods=["POST"])
def prediction_result():
    #receiving parameters sent by client
    age = int(request.form.get('age'))
    job = request.form.get('job')
    marital = request.form.get('marital')
    education = request.form.get('education')
    default = request.form.get('default')
    balance = int(request.form.get('balance'))
    housing = request.form.get('housing')
    loan = request.form.get('loan')
    contact = request.form.get('contact')
    day = int(request.form.get('day'))
    month = request.form.get('month')
    duration = int(request.form.get('duration'))
    campaign = int(request.form.get('campaign'))
    pdays = int(request.form.get('pdays'))
    previous = int(request.form.get('previous'))
    poutcome = request.form.get('poutcome')
    #load the trained model.
    filename = 'trained_model.pkl'
    loaded_model= joblib.load(filename)
    #create new dataframe
    data = {'age':age, 'job':job, 'marital':marital, 'education':education, 'default':default, 'balance':balance, 'housing':housing,
            'loan':loan, 'contact':contact, 'day':day, 'month':month, 'duration':duration, 'campaign':campaign, 'pdays':pdays,
            'previous':previous, 'poutcome':poutcome}
    pd.set_option('display.max_columns', None)
    pd.set_option('display.max_rows', None)
    df_input = pd.DataFrame(data, index=[0])
    #print(df_input.dtypes)
    result = loaded_model.predict(df_input)
    #print(result)
    for i in result:
      int_result = int(i)
      if (int_result == 0):
        decision = 'No'
      elif (int_result==1):
        decision = 'Yes'
      else:
        decision = 'Not defined'
    #return the output and load result.html
    return render_template('result.html', status=decision)

if __name__ == "__main__":
    #host= ip address, port = port number
    #app.run(host='127.0.0.1', port='5001')
    app.run()
```



FOLDERS

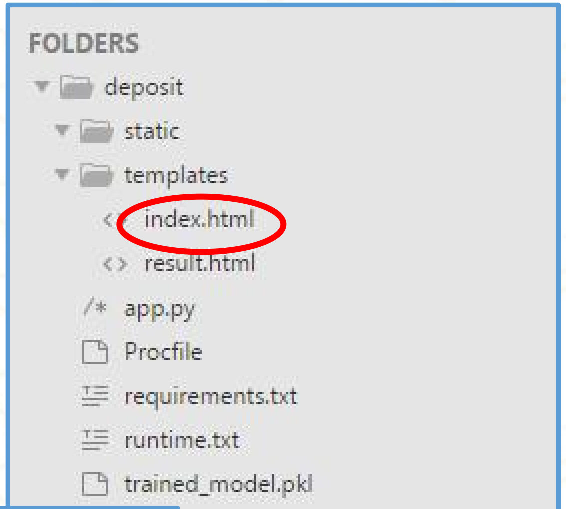
- deposit
  - static
  - templates
    - index.html
    - result.html
  - app.py
  - Procfile
  - requirements.txt
  - runtime.txt
  - trained_model.pkl

HTML interface (frontend)

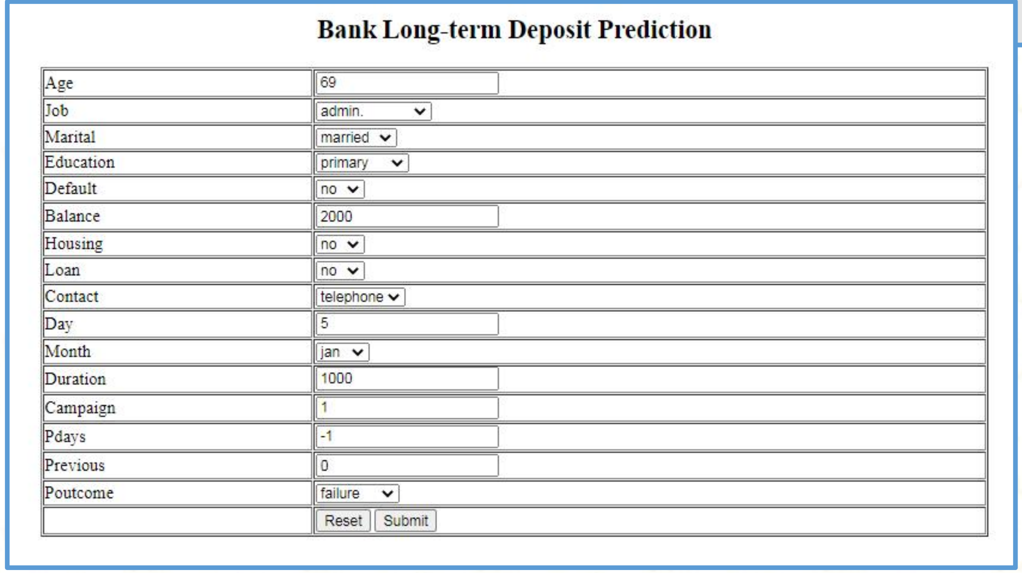


```
<head>
   <title>Bank Deposit Prediction</title>
</head>

<body>
      <center>
      <h2> Bank Long-term Deposit Prediction </h2><p><p>
      <form method = "post" action = "/result/">
                  <table border=1 width=50%>
                     <tr>
                        <td>Age</td>
                        <td>
                        <input type = "text" name="age" value="69">
                        </td>
                     </tr>
                <tr>
                        <td>Job</td>
                        <td>
                        <select name="job">
                       <option value="admin.">admin.</option>
                       <option value="technician">technician</option>
                       <option value="services">services</option>
                       <option value="management">management</option>
                       <option value="retired">retired</option>
                       <option value="blue-collar">blue-collar</option>
                       <option value="unemployed">unemployed</option>
                       <option value="entrepreneur">entrepreneur</option>
                       <option value="housemaid">housemaid</option>
                       <option value="self-employed">self-employed</option>
                       <option value="student">student</option>
                       <option value="unknown">unknown</option>
                  </select>
                        </td>
                     </tr>
                <tr>
                        <td>Marital</td>
                        <td>
                        <select name="marital">
                       <option value="married">married</option>
                       <option value="single">single</option>
                       <option value="divorced">divorced</option>
                  </select>
                        </td>
                     </tr>
```

index.html



hasil eksekusi

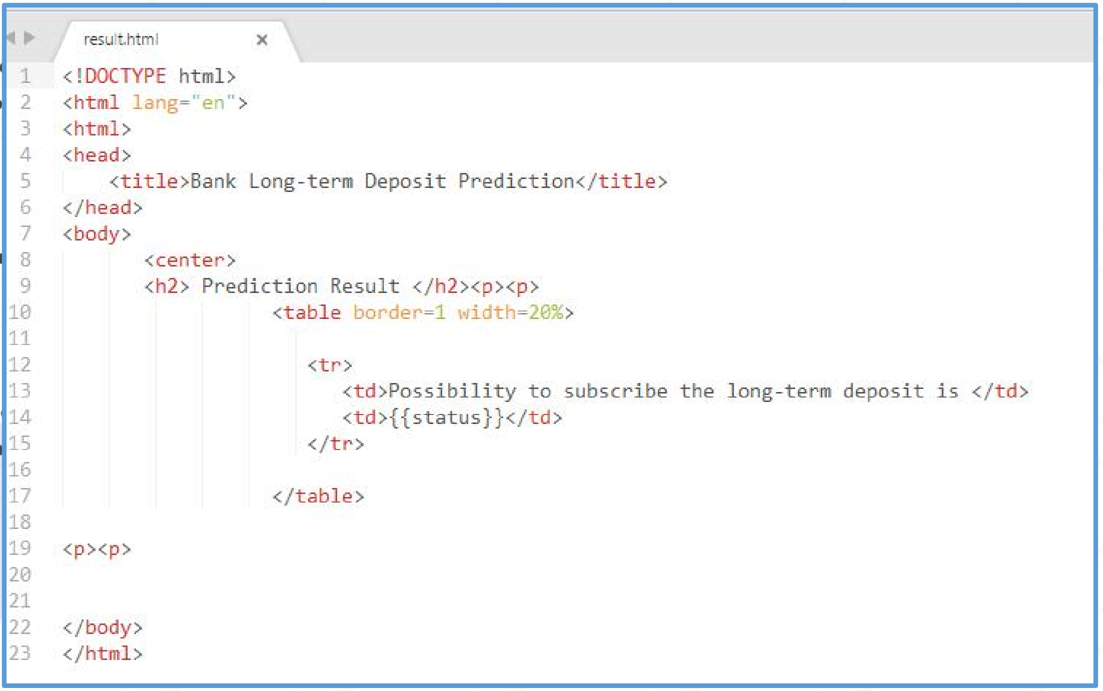


Bank Long-term Deposit Prediction

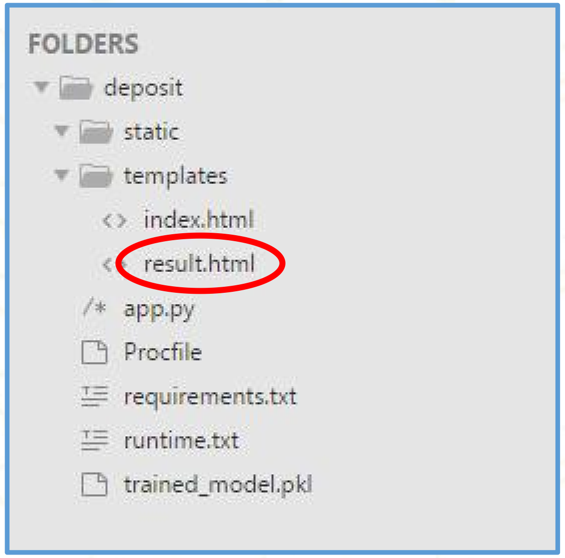
Age	69
Job	admin.
Marital	married
Education	primary
Default	no
Balance	2000
Housing	no
Loan	no
Contact	telephone
Day	5
Month	jan
Duration	1000
Campaign	1
Pdays	-1
Previous	0
Poutcome	failure
	Reset Submit

HTML interface (frontend)

result.html

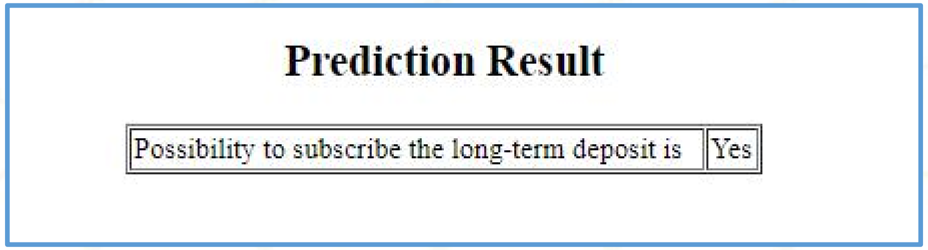


```
<!DOCTYPE html>
<html lang="en">
<html>
<head>
    <title>Bank Long-term Deposit Prediction</title>
</head>
<body>
       <center>
       <h2> Prediction Result </h2><p><p>
                  <table border=1 width=20%>

                     <tr>
                        <td>Possibility to subscribe the long-term deposit is </td>
                        <td>{{status}}</td>
                     </tr>

                  </table>

<p><p>


</body>
</html>
```



```
FOLDERS
▼ deposit
  ▼ static
  ▼ templates
      index.html
      result.html
    app.py
    Procfile
    requirements.txt
    runtime.txt
    trained_model.pkl
```

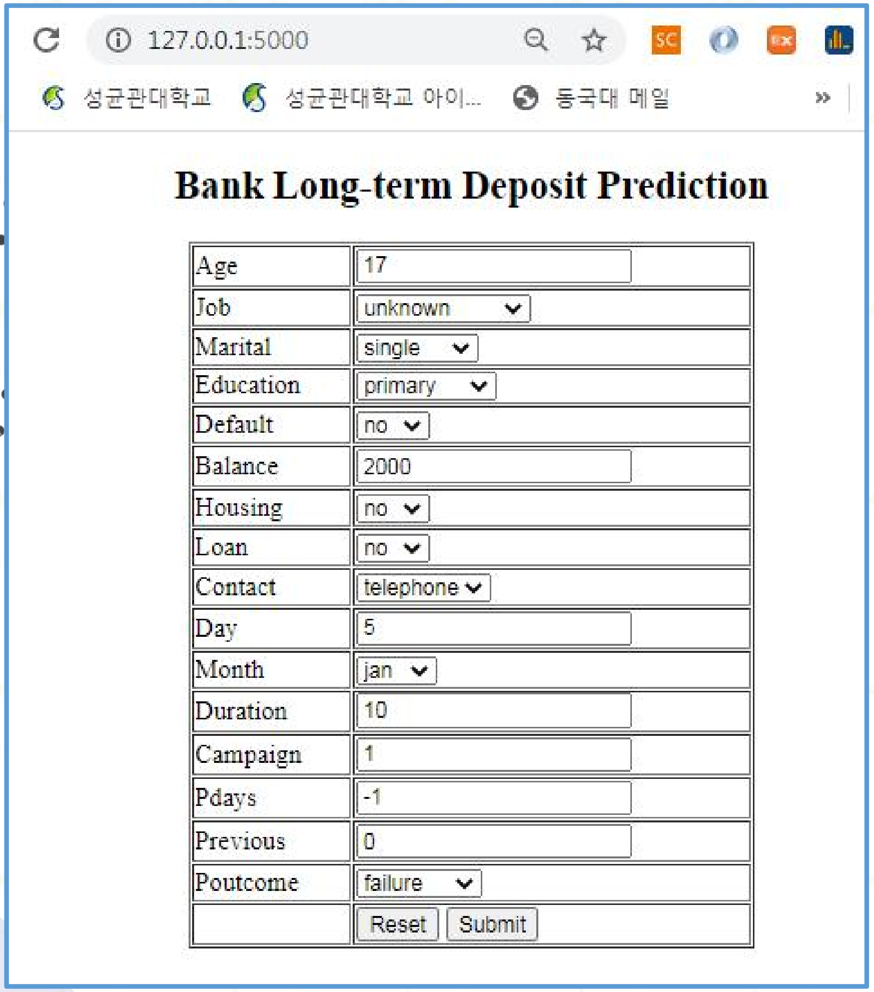
hasil eksekusi



Prediction Result

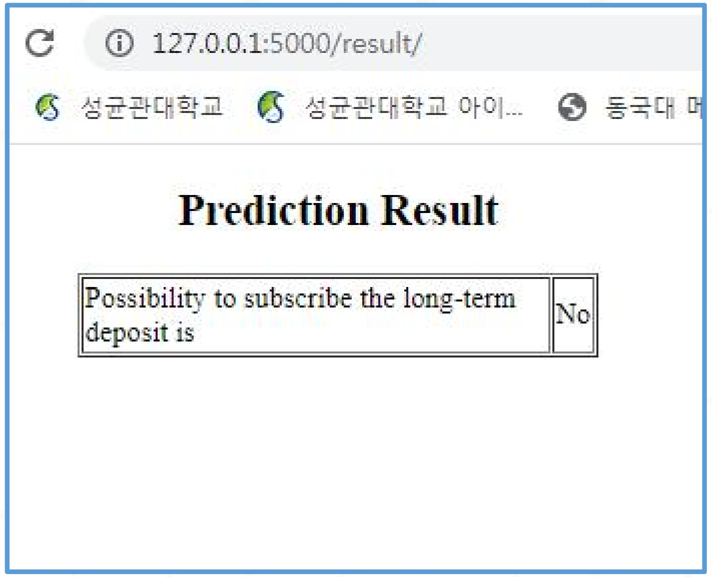
Possibility to subscribe the long-term deposit is	Yes

Result : running on local computer



Bank Long-term Deposit Prediction

Age	17
Job	unknown
Marital	single
Education	primary
Default	no
Balance	2000
Housing	no
Loan	no
Contact	telephone
Day	5
Month	jan
Duration	10
Campaign	1
Pdays	-1
Previous	0
Poutcome	failure
	Reset Submit



Prediction Result

Possibility to subscribe the long-term deposit is	No

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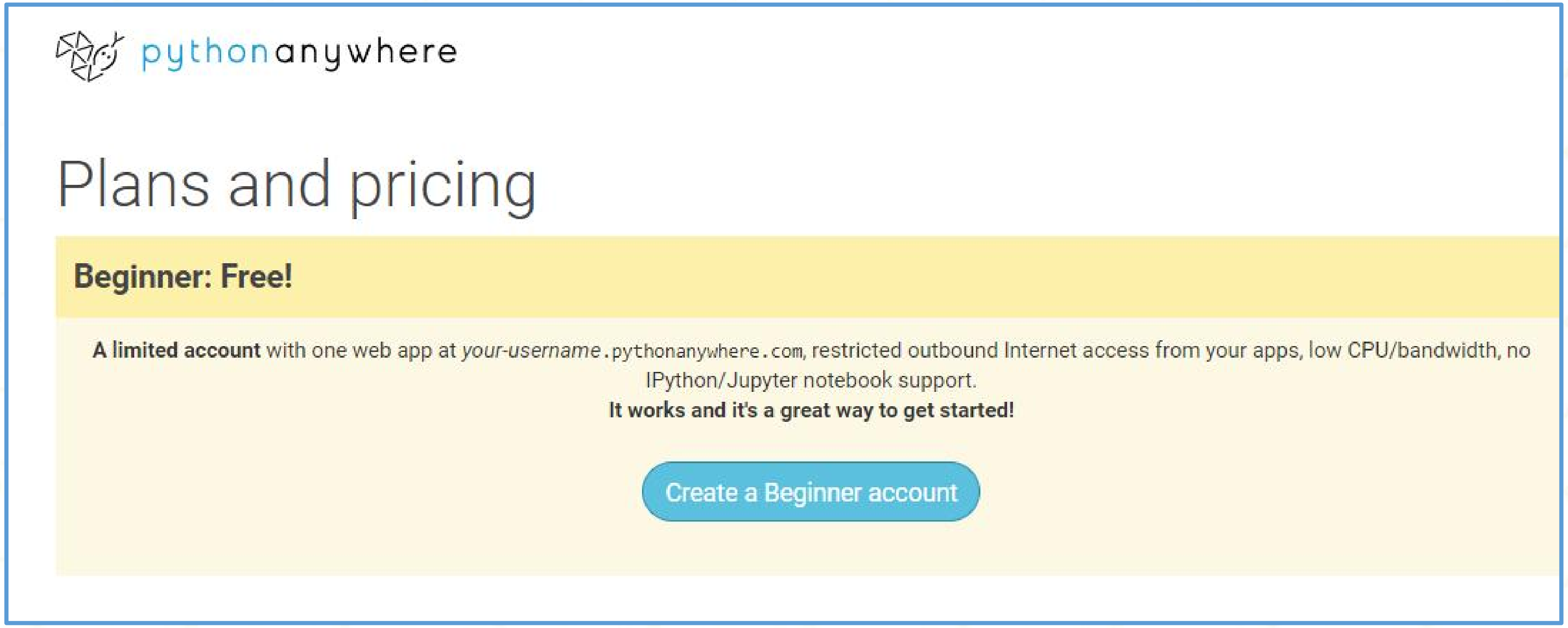
Deploy ML Model on PythonAnywhere

What is PythonAnywhere

- PythonAnywhere adalah sebuah *online integrated development environment* dan layanan *web hosting* berbasis bahasa pemrograman Python.
- Menyediakan layanan *access* menggunakan browser ke server berbasis Python dan juga *command-line interfaces*.

Create Account

- Buat account dahulu, free account



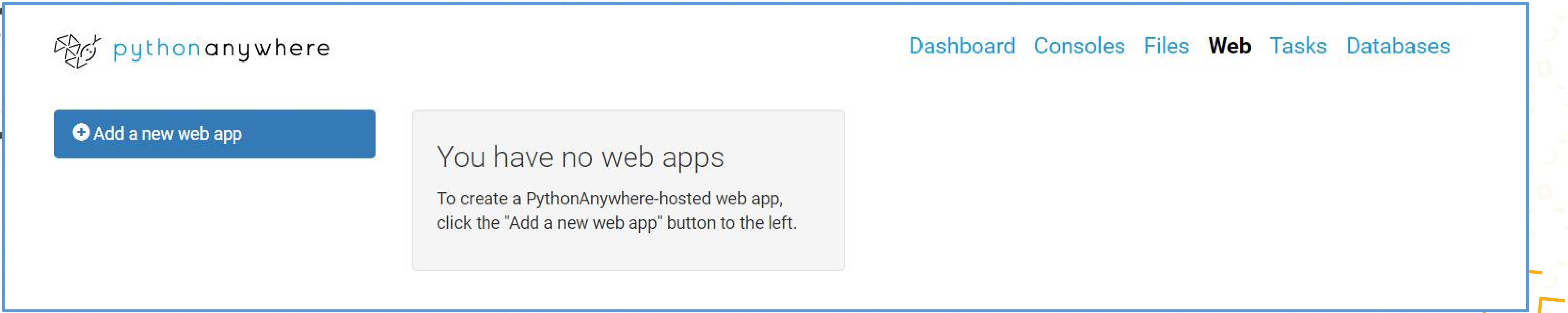
Plans and pricing

Beginner: Free!

A limited account with one web app at *your-username*`.pythonanywhere.com`, restricted outbound Internet access from your apps, low CPU/bandwidth, no IPython/Jupyter notebook support.
It works and it's a great way to get started!

Create a new web app

- Buat nama aplikasi-nya. By default sesuai dengan nama username pertama ketika sign up.

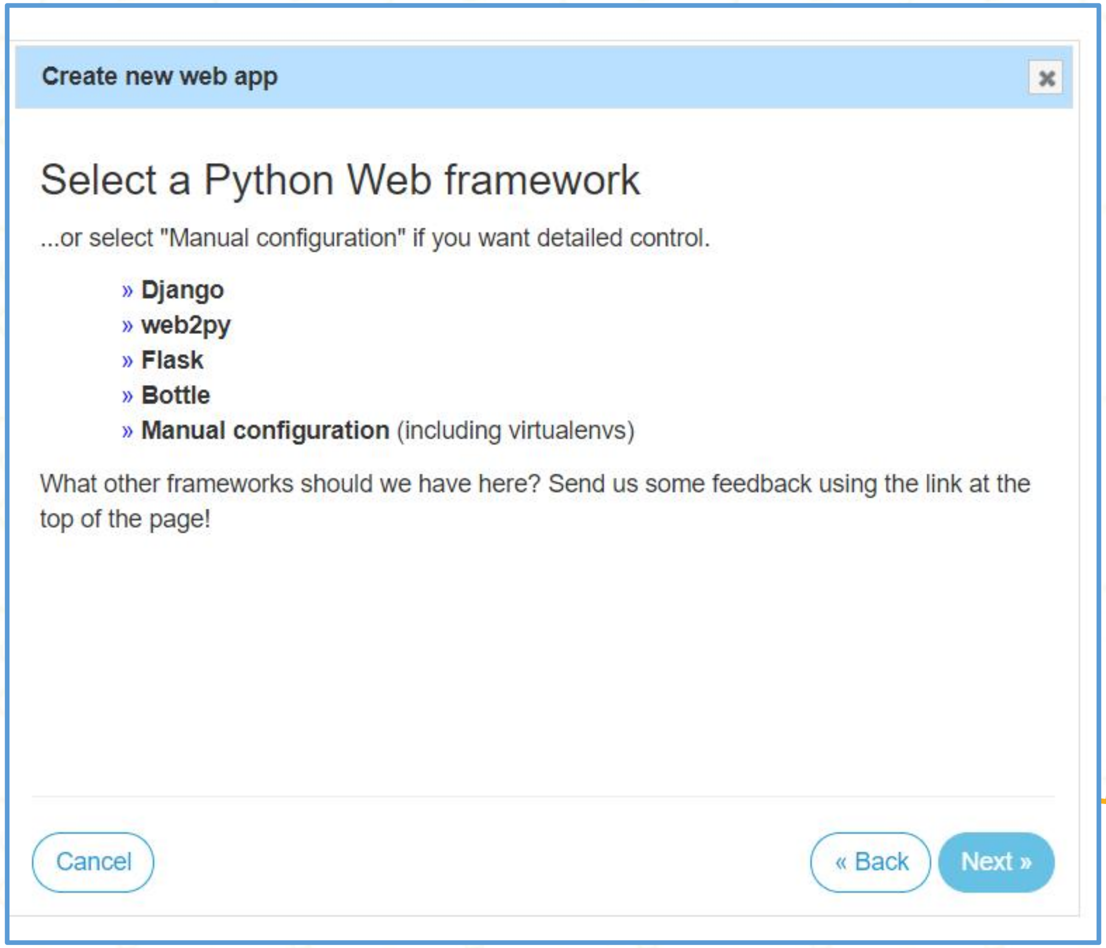


You have no web apps

To create a PythonAnywhere-hosted web app, click the "Add a new web app" button to the left.

Python Web Framework

- Kita menggunakan Flask sebagai web framework



Create new web app

Select a Python Web framework

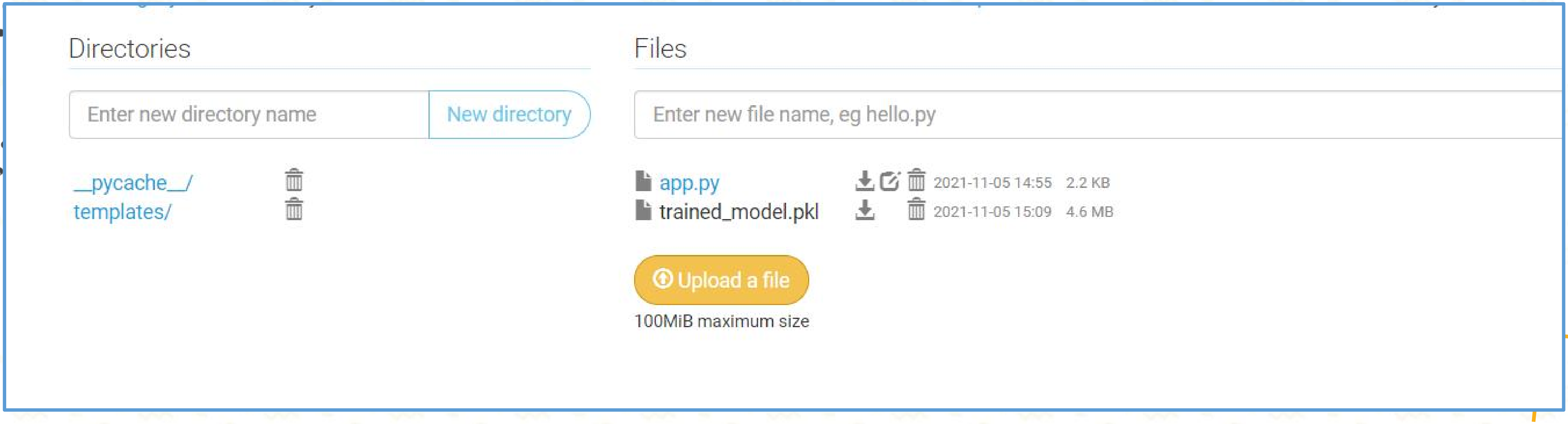
...or select "Manual configuration" if you want detailed control.

» **Django**
» **web2py**
» **Flask**
» **Bottle**
» **Manual configuration** (including virtualenvs)

What other frameworks should we have here? Send us some feedback using the link at the top of the page!

Upload Files

- Upload files dari komputer lokal ke cloud.



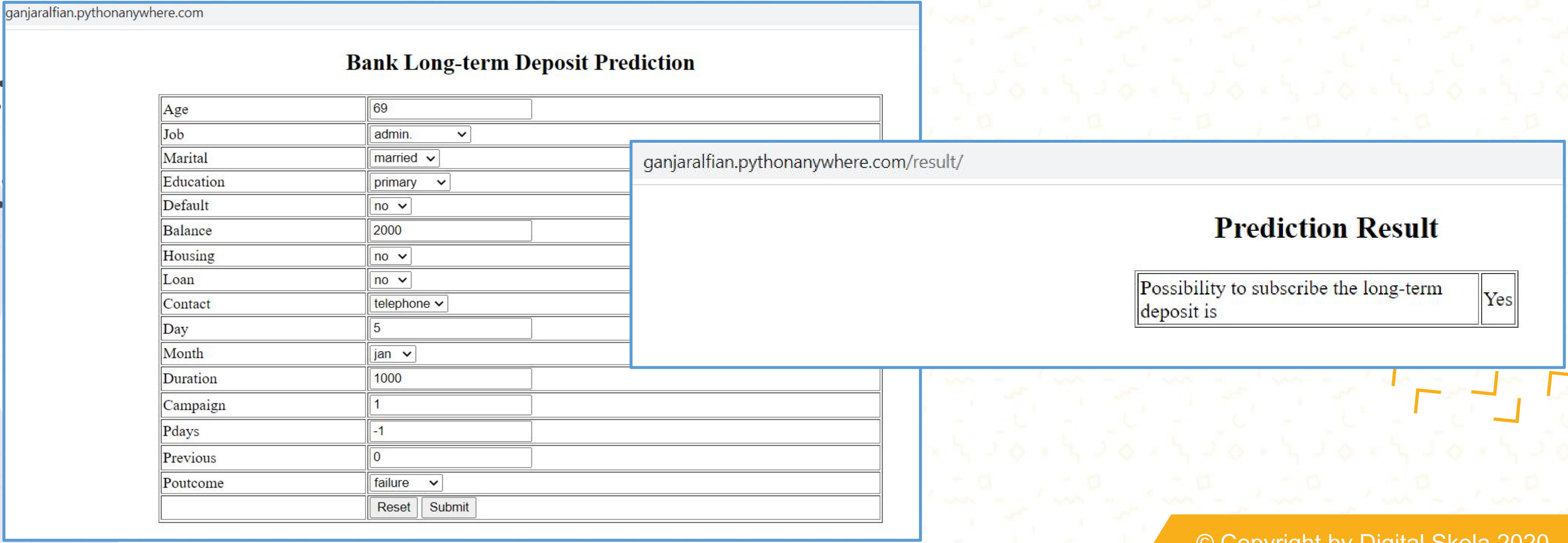
pycache/
templates/

app.py 2021-11-05 14:55 2.2 KB
trained_model.pkl 2021-11-05 15:09 4.6 MB

100MiB maximum size

Run the Web App

- Pastikan semua konfigurasi sudah benar.
- Jalankan program melalui web browser.



ganjaralfian.pythonanywhere.com

Bank Long-term Deposit Prediction

Age	69
Job	admin.
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Education	primary
Default	no
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Housing	no
Loan	no
Contact	telephone
Day	5
Month	jan
Duration	1000
Campaign	1
Pdays	-1
Previous	0
Poutcome	failure

ganjaralfian.pythonanywhere.com/result/

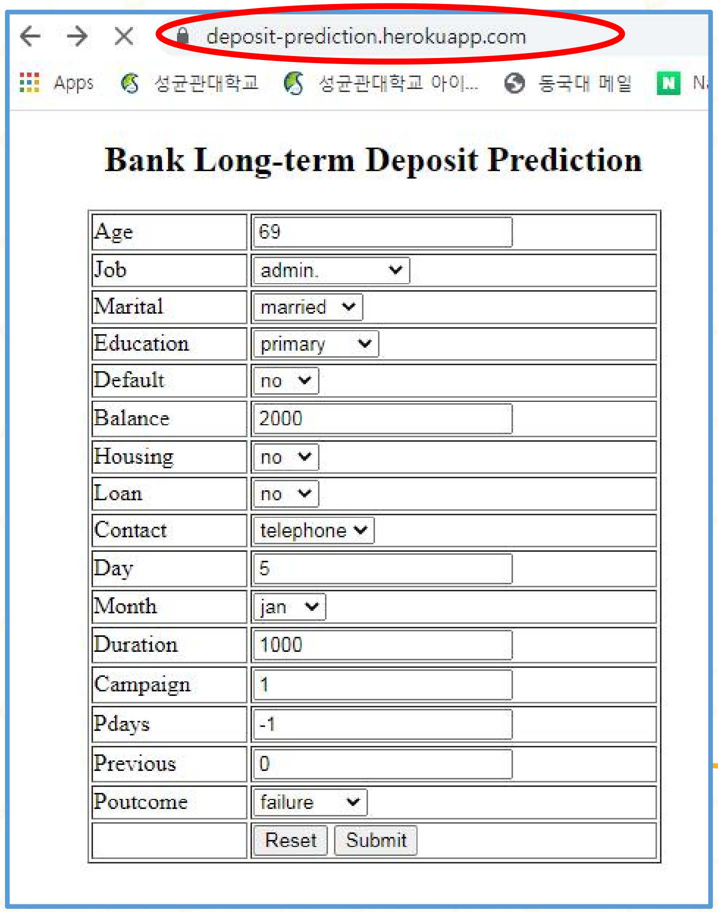
Prediction Result

Possibility to subscribe the long-term deposit is	Yes

Deploy ML Model on Heroku

What is Heroku

- Heroku adalah sebuah *platform as a service* (PaaS) yang memungkinkan programmer untuk membangun, menjalankan, dan mengoperasikan aplikasi sepenuhnya di *cloud.*
- Pertama-tama pastikan bahwa aplikasi diuji pada mesin lokal dahulu, setelah sukses kita siap untuk men-deploy aplikasi di *Heroku.*
- Langkah langkah
  - *Sign up for a free Heroku account*
  - Pastikan sudah meng-install *git*, untuk mengirim (push) aplikasi kita ke *Heroku.*
  - Meng-install *Heroku CLI tool.*



Bank Long-term Deposit Prediction

Age	69
Job	admin.
Marital	married
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Default	no
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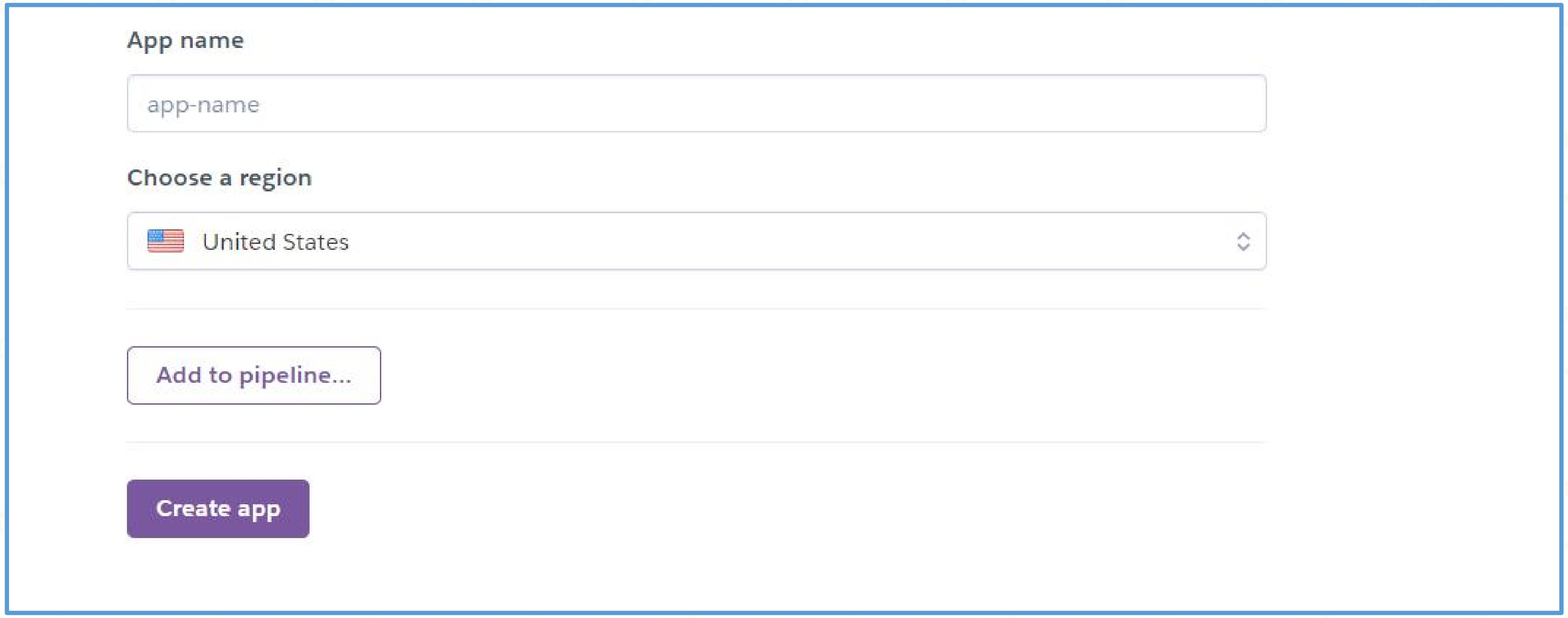
Housing	no
Loan	no
Contact	telephone
Day	5
Month	jan
Duration	1000
Campaign	1
Pdays	-1
Previous	0
Poutcome	failure
	Reset Submit

Create App

- Buat nama App, pastikan namanya belum dipakai.



App name

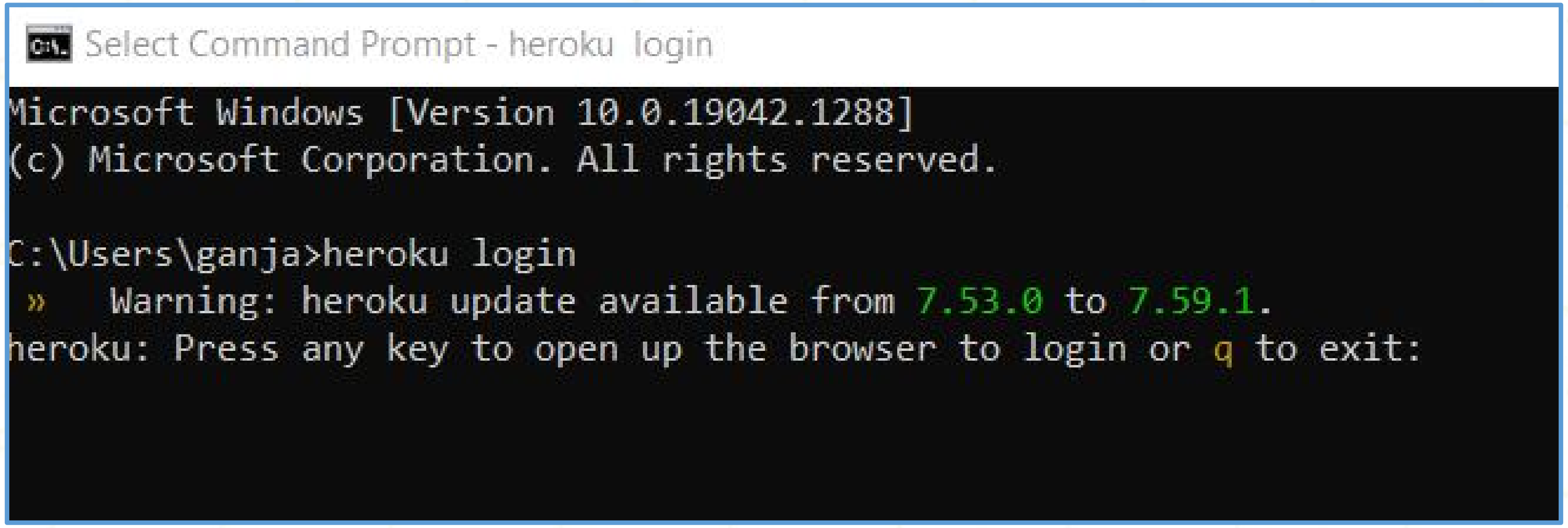
app-name

Choose a region

United States

Use Heroku CLI

- Pastikan Git sudah terinstall.
- Pastikan Heroku CLI sudah terinstall.
- Silahkan buka command prompt sebagai administrator.

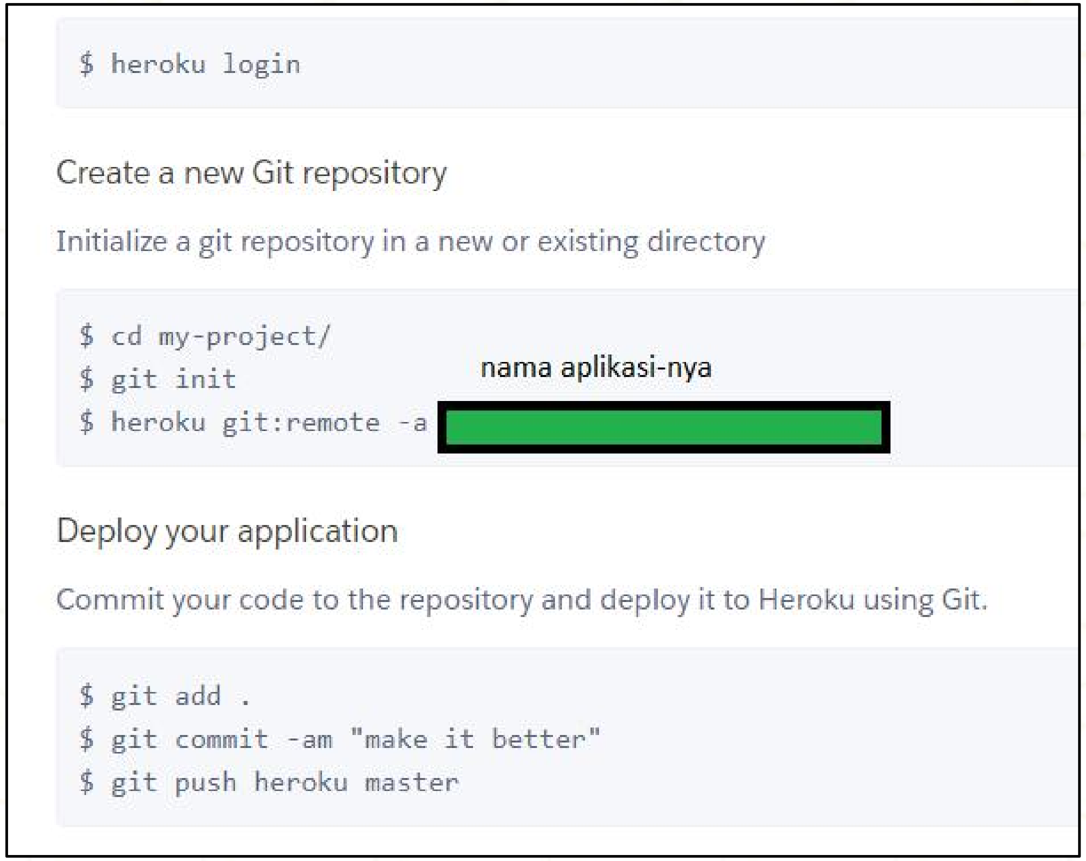


```
Microsoft Windows [Version 10.0.19042.1288]
(c) Microsoft Corporation. All rights reserved.

C:\Users\ganja>heroku login
 »   Warning: heroku update available from 7.53.0 to 7.59.1.
heroku: Press any key to open up the browser to login or q to exit:
```

Deploy it to Heroku using Git

- Untuk lebih jelasnya bisa dilihat di dashboard Heroku, kemudian klik menu “deploy”.
- Silahkan ikuti instruksi detailnya.



```
$ heroku login
```

Create a new Git repository

Initialize a git repository in a new or existing directory

```
$ cd my-project/
$ git init
$ heroku git:remote -a [redacted]
```

nama aplikasi-nya

Deploy your application

Commit your code to the repository and deploy it to Heroku using Git.

```
$ git add .
$ git commit -am "make it better"
$ git push heroku master
```

Additional References

1. https://www.freecodecamp.org/news/deploy-your-machine-learning-models-for-free/
2. https://medium.com/analytics-vidhya/how-to-deploy-simple-machine-learning-models-for-free-56cdccc62b8d

Let’s practice

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Thank YOU