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Batch code :

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Steps of deployment

1 – Wrote app.py

2- Created index.html

3- Created styles.css

4- Added error handling

5- Added CSRF protection

6- Added logging feature

7- Added data visualization

~\Desktop\DataGlacier\dataGlacier week3\my_flask_app\app.py

```python
import joblib
import numpy as np
import pandas as pd
from sklearn.datasets import load_iris
from sklearn.ensemble import RandomForestClassifier
from flask import Flask, request, jsonify, render_template
import matplotlib
matplotlib.use('Agg')  # Use the 'Agg' backend for Matplotlib
import matplotlib.pyplot as plt
import io
import base64
import logging
from logging.handlers import RotatingFileHandler
from flask_wtf import FlaskForm
from wtforms import FloatField, SubmitField
from wtforms.validators import DataRequired, NumberRange
from flask_wtf.csrf import CSRFProtect
import secrets

# Generate a random secret key
secret_key = secrets.token_hex(16)

app = Flask(__name__)
app.config['SECRET_KEY'] = secret_key  # Needed for CSRF protection
csrf = CSRFProtect(app)

# Setup logging
if not app.debug:
    file_handler = RotatingFileHandler('error.log', maxBytes=10240, backupCount=10)
    file_handler.setLevel(logging.INFO)
    formatter = logging.Formatter('%(asctime)s %(levelname)s: %(message)s [in %(pathname)s:%(lineno)d]')
    file_handler.setFormatter(formatter)
    app.logger.addHandler(file_handler)
    app.logger.setLevel(logging.INFO)
    app.logger.info('Iris Prediction App startup')

# Load the Iris dataset and model
iris = load_iris()
model = joblib.load('iris_model.pkl')

# Define the form class
class IrisForm(FlaskForm):
    sepal_length = FloatField('Sepal Length (cm)', validators=[DataRequired(), NumberRange(min=0)])
    sepal_width = FloatField('Sepal Width (cm)', validators=[DataRequired(), NumberRange(min=0)])
    petal_length = FloatField('Petal Length (cm)', validators=[DataRequired(), NumberRange(min=0)])
    petal_width = FloatField('Petal Width (cm)', validators=[DataRequired(), NumberRange(min=0)])
    submit = SubmitField('Predict')

@app.route('/', methods=['GET', 'POST'])
def home():
    form = IrisForm()
    if form.validate_on_submit():
        # Extract data from form
        features = [form.sepal_length.data, form.sepal_width.data, form.petal_length.data, form.petal_width.data]
        features = np.array([features])
        prediction = model.predict(features)
        species_names = iris.target_names[prediction]

        # Get feature importances
        importances = model.feature_importances_

        # Create a plot
        fig, ax = plt.subplots()
        y_pos = np.arange(len(iris.feature_names))
        ax.barh(y_pos, importances, align='center')
        ax.set_yticks(y_pos)
        ax.set_yticklabels(iris.feature_names)
        ax.invert_yaxis()
        ax.set_xlabel('Importance')
        ax.set_title('Feature Importances')

        # Save the plot to a PNG image in memory
        buf = io.BytesIO()
        plt.savefig(buf, format='png')
        buf.seek(0)
        image_base64 = base64.b64encode(buf.read()).decode('utf-8')
        buf.close()
        plt.close(fig)

        return render_template('index.html', form=form, prediction=species_names[0], feature_importance_plot=f"data:image/png;base64,{image_base64}")

    return render_template('index.html', form=form)

# Error handlers
@app.errorhandler(500)
def internal_error(error):
    app.logger.error(f"Server Error: {error}, Path: {request.path}")
    return render_template('500.html'), 500

@app.errorhandler(404)
def not_found_error(error):
    app.logger.error(f"Page Not Found: {error}, Path: {request.path}")
    return render_template('404.html'), 404

if __name__ == '__main__':
    app.run(debug=True)
```

~\Desktop\DataGlacier\dataGlacier week3\DataGlacier-Week4\my_flask_app\templates\index.html

```html
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Iris Prediction</title>
    <link href="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/css/bootstrap.min.css" rel="stylesheet">
    <!--<link rel="stylesheet" href="{{ url_for('static', filename='styles.css') }}"> -->

</head>
<body>
    <div class="container mt-5">
        <h1 class="text-center">Predict Iris Species</h1>

        <!-- Updated Form Structure -->
        <form method="POST" action="/" class="mt-4" id="predict-form">
            {{ form.hidden_tag() }} <!-- CSRF protection hidden tag -->
            <div class="form-group">
                {{ form.sepal_length.label(class="form-label") }}
                {{ form.sepal_length(class="form-control") }}
            </div>
            <div class="form-group">
                {{ form.sepal_width.label(class="form-label") }}
                {{ form.sepal_width(class="form-control") }}
            </div>
            <div class="form-group">
                {{ form.petal_length.label(class="form-label") }}
                {{ form.petal_length(class="form-control") }}
            </div>
            <div class="form-group">
                {{ form.petal_width.label(class="form-label") }}
                {{ form.petal_width(class="form-control") }}
            </div>
            <button type="submit" class="btn btn-primary">Predict</button>
        </form>

        <!-- Result Display Section -->
        {% if prediction %}
        <div class="alert alert-success mt-4" id="result">
            Prediction: {{ prediction }}
        </div>
        <h2 class="mt-5 text-center">Feature Importances</h2>
        <img id="feature-importance-plot" src="{{ feature_importance_plot }}" alt="Feature Importance plot" class="img-fluid mt-4">
        {% endif %}
    </div>

    <script src="https://code.jquery.com/jquery-3.2.1.slim.min.js"></script>
    <script src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.11.0/umd/popper.min.js"></script>
    <script src="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
    <script>
        document.getElementById('predict-form').addEventListener('submit', function(event) {
            document.getElementById('result').style.display = 'none';
            document.getElementById('feature-importance-plot').style.display = 'none';
        });
    </script>
</body>
</html>
```

~\Desktop\DataGlacier\dataGlacier week3\my_flask_app\static\styles.css

```css
body {
    font-family: Arial, sans-serif;
    background-color: #f0f8ff;
    margin: 0;
    display: flex;
    justify-content: center;
    align-items: center;
    height: 100vh;
}

.container {
    background-color: white
    padding: 20px;
    border-radius: 8px;
    box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
    text-align: center;
}

h1 {
    color: #333;
}

form {
    margin: 20px 0;
}

label {
    display: block;
    margin-bottom: 8px;
    font-weight: bold;
}

input[type="text"] {
    padding: 10px;
    width: 100%;
    box-sizing: border-box;
    margin-bottom: 10px;
    border: 1px solid #ccc;
    border-radius: 4px;
}

button {
    padding: 10px 20px;
    background-color: #007BFF;
    color: white
    border: none;
    border-radius: 4px;
    cursor: pointer;
}

button:hover {
    background-color: #0056b3;
}

h2 {
    color: #333;
    margin-top: 20px;
}
```