Documentation: Flow of Information in the Codebase

This codebase demonstrates the integration of a machine learning model (Decision Tree Regressor) with a FastAPI application for making predictions. Below is an explanation of the flow of information through the different modules and their interactions, incorporating insights from your flowchart(fastapi_flowchart_pickle).

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1. Model Training (`model_making.py`)

- **Purpose:** Train a Decision Tree Regressor using the California Housing dataset and save the trained model for later use.
- **Steps:**
    - **Dataset Preparation:**
        - Load the California Housing dataset.
        - Use the first four features (`feature1`, `feature2`, `feature3`, `feature4`) as predictors.
        - Split the dataset into training and testing sets (`80-20` split).
    - **Data Standardization:**
        - Standardize the features using `StandardScaler` for consistent scaling across training and testing data.
    - **Model Training:**
        - Train a `DecisionTreeRegressor` on the standardized training data.
    - **Model Saving:**
        - Save the trained model as a pickle file (`dt_model_regression.pkl`) for later use by the FastAPI application.
- **Output:**
    - A serialized file (`dt_model_regression.pkl`) containing the trained model.

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2. Prediction Functionality (`model.py`)

- **Purpose:** Load the saved model (`dt_model_regression.pkl`) and define a function for making predictions based on input data.
- **Steps:**
    1. **Model Loading:**
        - A function (`load_model`) deserializes and loads the pickled model using Python's `pickle` module.
    2. **Prediction:**
        - Define the `predict` function, which:

        - Loads the model using `load_model`.
        - Takes input data (in the form of a Pandas DataFrame).
        - Makes predictions using the loaded model.
        - Converts and returns the predictions as a list (for JSON-friendly API responses).

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3. FastAPI Application (`main.py`)

- **Purpose:** Provide an API endpoint to accept user input, process the data, and return model predictions.
- **Steps:**
    1. **Define Input Validation (`InputData`):**
        - Use Pydantic to define a schema for incoming requests.
        - Expect `feature1`, `feature2`, `feature3`, and `feature4` as `float` inputs.
    2. **API Endpoint for Prediction:**
        - **Endpoint:** `POST /predict/`
        - **Flow:**
            - Accept JSON input validated by the `InputData` model.
            - Convert the validated input into a Pandas DataFrame.
            - Call the `predict` function from `model.py` to obtain predictions.
            - Return the predictions as a JSON response.
    3. **Server Setup:**
        - Start the FastAPI server to serve the endpoint.

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4. Flow of Information

1. **Model Training:**
    - `model_making.py` trains the model and saves it as `dt_model_regression.pkl`.
2. **Model Usage:**
    - `model.py` defines functions to load the pickled model and make predictions.
3. **User Interaction:**
    - Users interact with the API by sending a POST request to `/predict/` with JSON input data.
4. **Response Generation:**
    - The server converts the input data into a DataFrame, makes predictions, and returns the result in JSON format.

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5. Flowchart Integration

The flowchart provided visually represents the following steps:

1. **Model Training:**
    - Data preparation and model training in `model_making.py`.
    - Serialization of the trained model into `dt_model_regression.pkl`.
2. **Model Loading and Prediction:**
    - `model.py` loads the serialized model and defines a prediction function.
3. **API Endpoint:**
    - `main.py` integrates the prediction function with FastAPI.
    - User input is processed, predictions are generated, and outputs are returned.
4. **Output Delivery:**
    - The final prediction is sent back to the user through the API endpoint.