1. How to collect and calculate data

step1: Data Collection and Sources

- Identify the data sources required for carbon calculation.

  This may include: energy consumption, transportation, waste, and other factors.
  Possible sources include: weather and climate data, industry-specific data sets and so on.
  From two aspects: individuals and commercial/industrial

- Consider using APIs to automate data retrieval from relevant sources.

  Utility APIs, transportation APIs, environmental APIs
  Satellite and Remote sensing data
  Smart Devices and IoT sensors
  Government Databases and Reports

step2: Security and Privacy

- Data Encryption: *Use SSL/TLS to secure data in transit.*
- Secure Authentication and Authorization: *Use MFA to verify user identities.*
- Data Minimization and Retention Policies: *Collect the necessary data and delete after a specified.*
- Secure Development Practices: *Minimize vulnerabilities in the platform's code.*
- Regular Updates and Patch Management: *Keep all software components up-to-date.*
- Secure Database Management: *Utilize secure database practices.*

step3: Data Processing and Modeling

- Data Preprocessing: *cleaning, filtering and transforming the data ⇢ ensure quality and consistency*
- Emission Factors: *estimate the amount of greenhouse gases produced or removed per unit of activity.*

  - ***Air Travel (Short Haul)**: Approximately 0.24 kg CO2 per passenger-kilometer.*
  - ***Air Travel (Long Haul)**: Approximately 0.18 kg CO2 per passenger-kilometer.*
  - ***Coal**: Approximately 0.937 kg CO2 per kWh.*
  - ***Natural Gas**: Approximately 0.443 kg CO2 per kWh.*
  - ***Natural Gas Heating**: Approximately 2.19 kg CO2 per cubic meter of natural gas.*
  - ***Electric Heating (using fossil fuel-based grid)**: Depends on the emissions intensity of the electricity grid.*
  - ***Steel Production**: Approximately 1.8-2.2 kg CO2 per kg of steel produced, depending on the production process.*

- Conversion Formulas: *Use specific conversion formulas to calculate emissions.*

- ***For short-haul flights:***

*Emissions (kg CO2) = Distance Traveled (km) * Emission Factor (kg CO2/passenger-km) for short-haul flights.*

- ***For long-haul flights:***

*Emissions (kg CO2) = Distance Traveled (km) * Emission Factor (kg CO2/passenger-km) for long-haul flights.*

- ***Steel Production:***

*Emissions (kg CO2) = Steel Production (kg) * Emission Factor (kg CO2/kg of steel)*

- ***For Coal:***

*Emissions (kg CO2) = kWh * Emission Factor (kg CO2/kWh) for coal-fired generation.*

- ***For Natural Gas:***

*Emissions (kg CO2) = kWh * Emission Factor (kg CO2/kWh) for natural gas-fired generation.*

◦ Unit Standardization

◦ Integration of Emission Calculation Methodologies: *IPCC guideline*

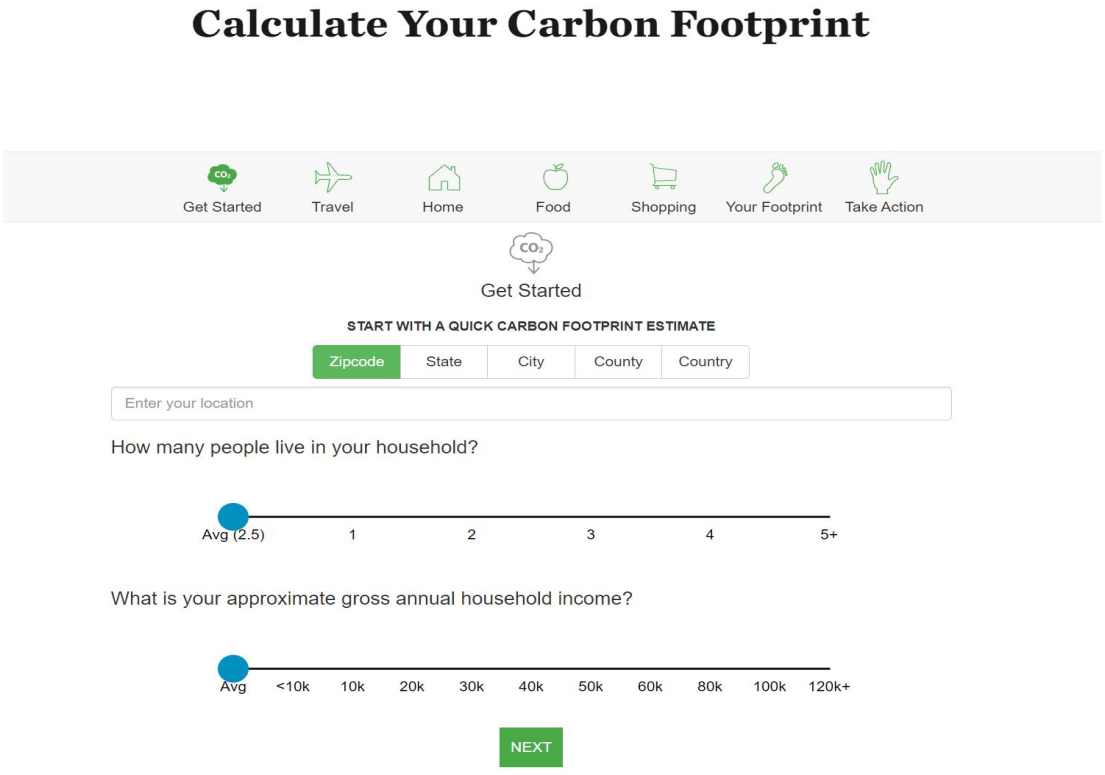
◦ Model Selection:

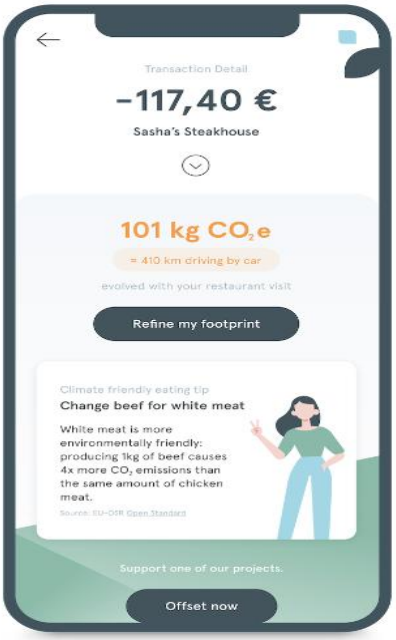
Simple linear model
more complex model: regression models, machine learning models

◦ Scenario Analysis and Validation and Accuracy Assessment

◦ Feedback Loops and Continuous Improvement

◦ Sensitivity and Error Analysis





2. The difficulty:

merchant data is often not sufficient to identify which product category from the merchant was actually purchased.