# Solar Rooftop Analyzer Using Segment Anything Model (SAM)

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# Project Overview

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This project implements an AI-powered solar rooftop analysis tool that leverages the Segment Anything Model (SAM) developed by Meta AI to automatically segment rooftop areas from satellite or aerial images. The segmented rooftop area is then used to estimate the solar panel installation potential, installation cost, lifetime savings, and Return on Investment (ROI) for solar energy systems.

**Objectives**

- Use cutting-edge image segmentation to detect rooftop areas accurately.

- Provide actionable solar installation insights based on segmented rooftop size.

- Build a user-friendly web application interface using Streamlit for image upload and interactive results display.

**Technologies & Tools Used**

- Segment Anything Model (SAM): Pre-trained vision transformer-based segmentation model.

- PyTorch: Deep learning framework used to load and run the SAM model.

- Streamlit: Python framework for building the web interface.

- OpenCV & Pillow: Image processing and manipulation.

- NumPy: Numerical operations.

- Python 3.x: Programming language.

**Code Structure & Workflow**

1. segmenter.py

- Loads the SAM model with the vit\_b architecture and specified checkpoint.

- Defines the segment\_rooftop function which:

- Reads the input image.

- Uses SAM to segment the rooftop area based on a point prompt (center of image).

- Returns the masked rooftop image and the number of pixels detected as rooftop.

2. analysis.py

- Defines estimate\_roi function which calculates:

- Potential solar power generation (kW).

- Installation cost (₹) based on area and price per watt.

- Lifetime savings assuming 25 years of solar power usage.

- ROI as savings minus installation cost.

3. app.py

- Implements the Streamlit app:

- Allows user to upload satellite images (jpg, jpeg, png).

- Displays the original uploaded image.

- Runs rooftop segmentation and shows the segmented result.

- Calculates rooftop area and displays cost, savings, and ROI estimates interactively.

**Assumptions & Notes**

- Pixel area conversion assumes 1 pixel ≈ 0.25 m² — this can be refined with georeferencing.

- Model checkpoint sam\_vit\_b.pth must be downloaded separately from the official SAM GitHub.

- The app currently segments rooftop area based on a single point prompt at image center; this can be extended to multiple prompts for complex scenes.

- ROI calculations use fixed panel efficiency and price per watt but can be customized.

**How to Run**

1. Set up the Python environment with required libraries using:

pip install -r requirements.txt

2. Download sam\_vit\_b.pth checkpoint and place it in the project folder.

3. Run the Streamlit app:

streamlit run app.py

4. Upload a suitable satellite/aerial rooftop image (jpg/png).

5. View segmented rooftop and solar installation estimates in the app.

# Summary

This project demonstrates how state-of-the-art segmentation models can be integrated into practical renewable energy applications, enabling intelligent rooftop solar potential assessment from imagery with minimal manual input.