**ImageGPT**:

To create comprehensive dataset of geospatial and geosciences related information.To create curated LLM model to give context aware responses to user queries.User friendly interface with Image as a input option along with text prompt .Write localized loss function and optimizer.Task Identified: Point features ,polygon features,Line Features,other micro and macro features like Water bodies & Sand Dessert,HT tower,Building Etc.

The complete project can be divided into multiple modules:

### **Image Preprocessing Module**

* **Task:** Handle image input, format conversion, and basic preprocessing.
* **Responsibilities:**
  + Image loading and handling (supporting TIFF, JPEG, PNG, etc.).
  + Frame extraction for TIFs.
  + Basic preprocessing (resizing, normalization, color space conversion).
  + Output: Preprocessed images ready for feature extraction.
* **Skills Required:** Python, GDAL,Rasterio,QGIS, PIL (Pillow).

### **2. Feature Extraction Module**

* **Task:** Extract relevant features from images for further analysis.
* **Responsibilities:**
  + Implement feature extraction algorithms (SIFT, SURF, ORB).
  + Use pre-trained models for feature extraction (e.g., ResNet, VGG).
  + Develop custom feature extraction methods if necessary.
  + Output: Feature vectors representing the images.
* **Skills Required:** Python, Machine Learning,Deep Learning TensorFlow/PyTorch.

### **3. Object Detection Module**

* **Task:** Detect and identify objects (e.g., buildings) in images.
* **Responsibilities:**
  + Implement object detection models (YOLO, Faster R-CNN, SSD).
  + Train models on relevant datasets.
  + Integrate models to detect and count buildings.
  + Output: Bounding boxes and labels for detected objects.
* **Skills Required:** Python, TensorFlow/PyTorch,DL,ML,GAN

### **4. Geospatial Data Processing Module**

* **Task:** Convert image data into geospatial formats like shapefiles.
* **Responsibilities:**
  + Map detected objects to geospatial coordinates.
  + Generate shapefiles or other GIS-compatible outputs.
  + Handle spatial reference systems and coordinate transformations.
  + Output: Shapefiles or GeoJSON with detected features.
* **Skills Required:** Python, Geopandas, Shapely, GDAL/OGR,Rasterio,QGIS.

### **5. Natural Language Processing (NLP) Module**

* **Task:** Process user prompts and interpret requests.
* **Responsibilities:**
  + Implement prompt parsing and understanding using NLP techniques.
  + Map user requests to system functionalities.
  + Use pre-trained language models (e.g., GPT-4) for understanding complex queries.
  + Output: Structured commands for the system based on user input.
* **Skills Required:** Python, NLP libraries (spaCy, NLTK), Hugging Face Transformers.

### **6. Integration and API Module (GUI Optional)**

* **Task:** Integrate all components and provide a user-facing API.
* **Responsibilities:**
  + Develop a RESTful API to interface with the system.
  + Handle input/output data flow between modules.
  + Ensure robust error handling and data validation.
  + Output: Working API endpoint for user interaction.
* **Skills Required:** Python, FastAPI/Flask, REST principles.

**Segmentation in Remote sensing Imagery using AI/ML:**

Segmentation in remote sensing, a critical task for extracting meaningful information from satellite imagery. Segmentation approaches often struggle to accurately delineate objects or features due to the complexity of environmental conditions, spectral variability, and the heterogeneous nature of remote sensing data. Deep learning holds promise for improving segmentation accuracy by leveraging learned high-level feature representations from extensive datasets. However, several obstacles impede its effective application in this domain. These include the scarcity and quality of remote sensing data, spatial and spectral variability across different regions and time periods. Overcoming these challenges is vital to advancing the efficacy of deep learning methods for remote sensing segmentation, facilitating applications such as land cover classification, urban planning, environmental monitoring, and disaster management.

This complete task is categorized into:

### **1. Image Preprocessing Module**

* **Task:** Handle image input, format conversion, and basic preprocessing.
* **Responsibilities:**
  + Image loading and handling (supporting TIFF, JPEG, PNG, etc.).
  + Basic preprocessing (resizing, normalization, color space conversion).
  + Output: Preprocessed images ready for feature extraction.
* **Skills Required:** Python, GDAL, Rasterio,QGIS, PIL (Pillow).

1. **Feature extraction using AI/ML:**

* **Task:** Utilize advanced segmentation methods to extract features like buildings, roads, airports, and solar farms from multi-spectral or panchromatic imagery.
* **Responsibilities:**

Explore and implement various deep learning architectures such as UNet, Deeplab, and encoder-decoder based models (FCN).

Investigate multi-scale models like FPN and PSPNet for improved feature extraction accuracy.

* **Skills Required:** Strong background in AI/ML, familiarity with deep learning frameworks like keras, tensorflow, pytorch, and proficiency in image segmentation techniques.

1. **Geospatial Data Processing Module:**

* **Task:** Convert image data into geospatial formats like shapefiles.
* **Responsibilities:**
  + Map detected objects to geospatial coordinates.
  + Generate shapefiles or other GIS-compatible outputs.
  + Handle spatial reference systems and coordinate transformations.
  + Output: Shapefiles or GeoJSON with detected features.
* **Skills Required:** Python, Geopandas, Shapely, GDAL/OGR,Rasterio,QGIS.