WELCOME

GET STARTED

Large Scale Synthetic-Data-Generation-for-Computer-Vision-AI-ML

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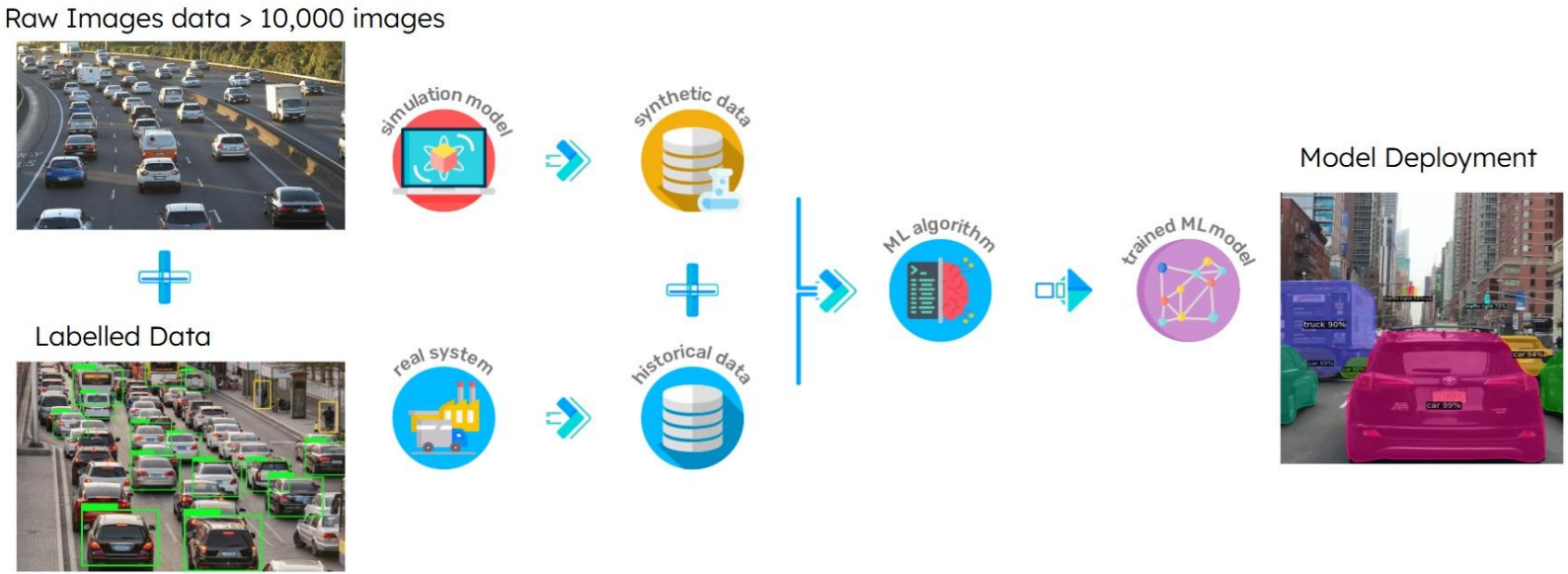
What is Synthetic data generation ?

Large-scale synthetic data generation involves creating a huge numbers of data like images, sound text, statistical data etc using labelling and designing softwares or by using another ai models. but in this research this synthetic data generation means of creating the huge amount of **realistic, computer-generated images** using **3D software like Blender** to train AI models.

Computer vision Ai model Training approach:-



Need of Synthetic data generation for computer vision

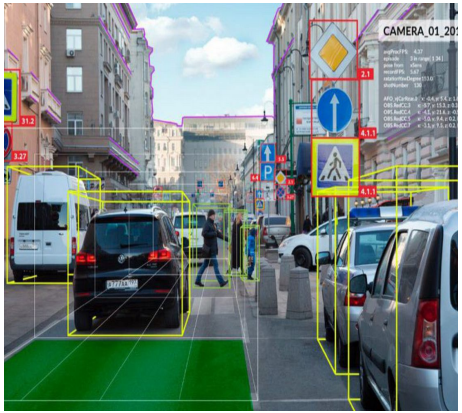
Deep learning outperforms traditional ML by mimicking the human brain but needs vast labeled data. Synthetic data solves this by simulating environments, improving accuracy, and enhancing deep learning model generalization for real-time image tasks.

Here are some common problems arrived in traditional image data preparation.

PROBLEMS

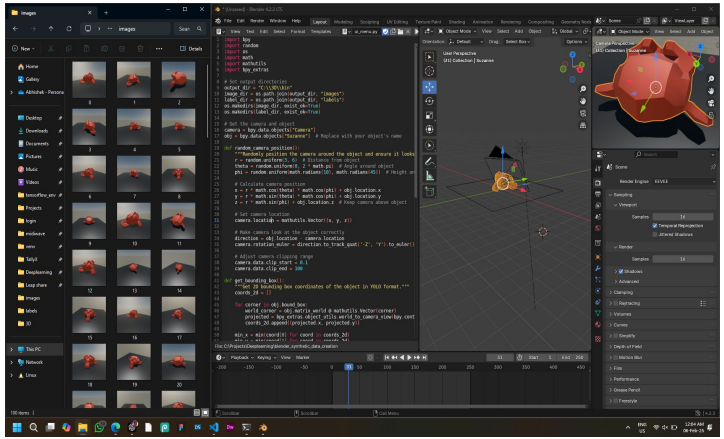
1.Image data Scarcity and variations

2. 3D Depth understanding

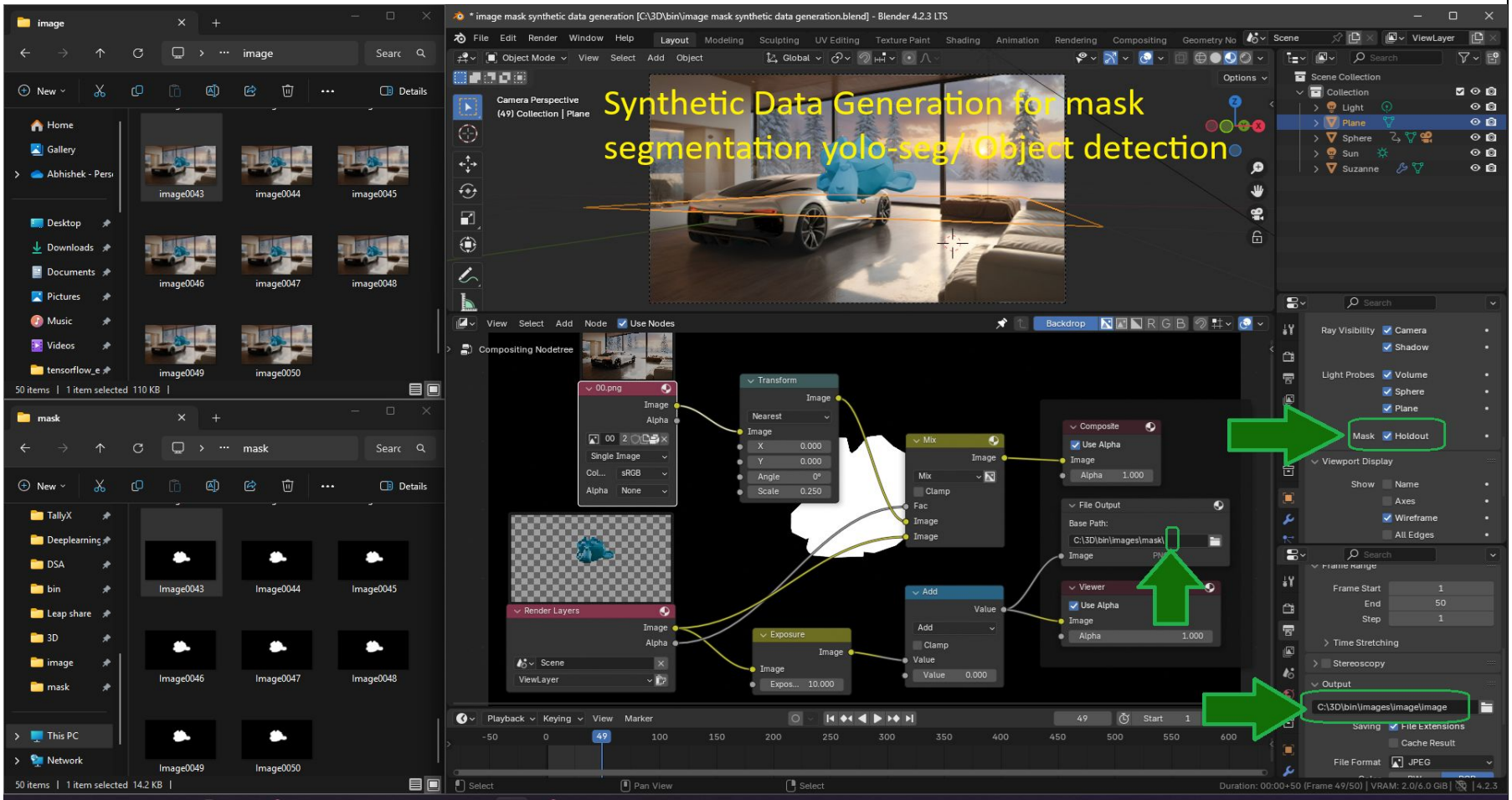


SOLUTION

Generate millions of synthetic images data using Open Source 3D software like Blender , to train Ai models efficiently.

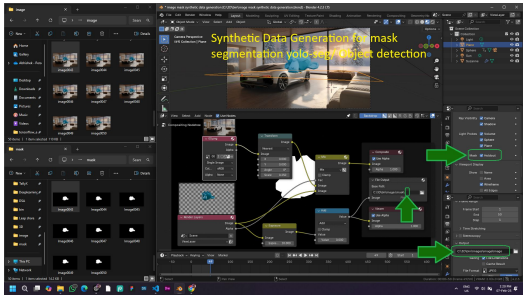


Blender 4.2 Snapshot for creating masked image data of 3d model

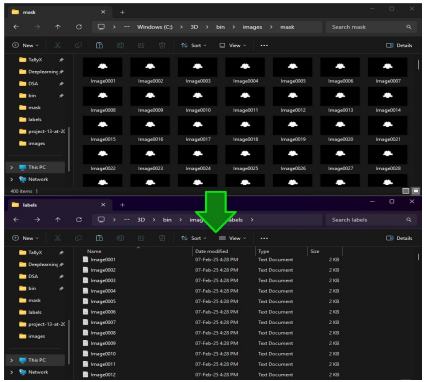


Research implementation process

1.Creation of photorealistic rendered images and masked images data from 3d model in Blender



2.Convert masked images to polygons labelled data using our python program



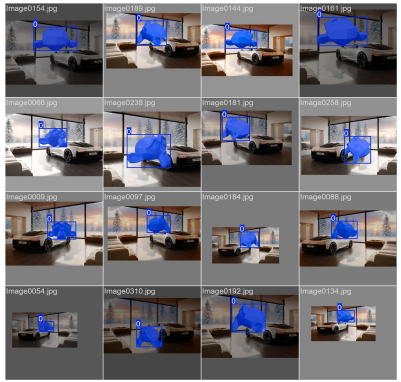
3. Move the images data in the valid directory structure for training the Yolo v8-segmentation model

```
bash                                                    Copy  Edit

/home/abhi/tensorflow_env/segment/  # Root directory of dataset
├─ dataset.yaml                     # Dataset configuration file
├─ images/
│  ├─ train/                        # Training images
│  │  ├─ Image0001.jpg
│  │  ├─ Image002.jpg
│  │  ├─ ...
│  ├─ val/                          # Validation images
│  │  ├─ Image0101.jpg
│  │  ├─ Image0102.jpg
│  │  ├─ ...
├─ labels/
│  ├─ train/                        # Training labels (polygon format)
│  │  ├─ Image0001.txt
│  │  ├─ Image0002.txt
│  │  ├─ ...
│  ├─ val/                          # Validation labels (polygon format)
│  │  ├─ Image0101.txt
│  │  ├─ Image0102.txt
│  │  ├─ ...
```

4. Train the ML Model using these datasets

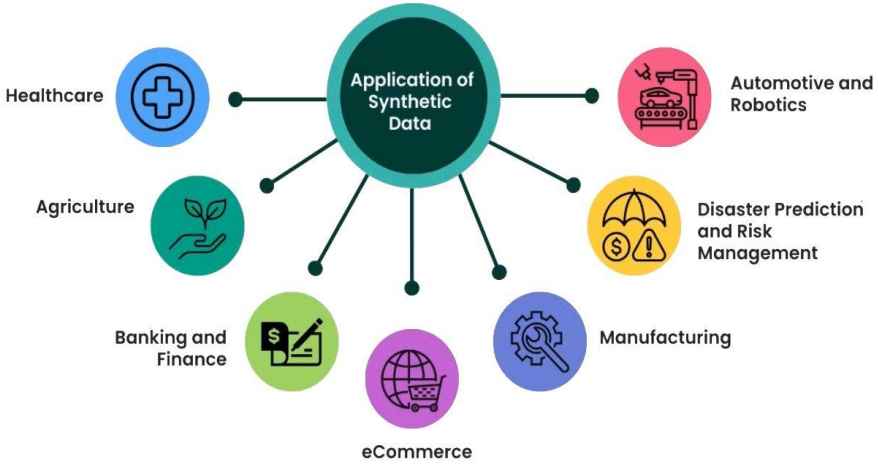
```
Starting training for 50 epochs...

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        1/50         0G      1.863       3.75      2.386         31       1280: 100%|██████████| 47/47 [14:43<00:00, 18.
                   Class     Images  Instances      Box(P          R      mAP50  mAP50-95):   0%|          | 0/3 [00:00<?W
ARNING  NMS time limit 1.300s exceeded
                   Class     Images  Instances      Box(P          R      mAP50  mAP50-95):  33%|███▎      | 1/3 [00:20<0W
ARNING  NMS time limit 1.300s exceeded
                   Class     Images  Instances      Box(P          R      mAP50  mAP50-95):  67%|██████▋   | 2/3 [00:37<0W
ARNING  NMS time limit 0.900s exceeded
                   Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████████| 3/3 [00:45<0
                     all         40         49    0.00351      0.429      0.111     0.0343

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        2/50         0G      1.735      3.175      2.238         32       1280: 100%|██████████| 47/47 [15:03<00:00, 19.
                   Class     Images  Instances      Box(P          R      mAP50  mAP50-95):   0%|          | 0/3 [00:00<?W
ARNING  NMS time limit 1.300s exceeded
                   Class     Images  Instances      Box(P          R      mAP50  mAP50-95):  33%|███▎      | 1/3 [00:15<0W
ARNING  NMS time limit 1.300s exceeded
                   Class     Images  Instances      Box(P          R      mAP50  mAP50-95):  67%|██████▋   | 2/3 [00:31<0W
ARNING  NMS time limit 0.900s exceeded
                   Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████████| 3/3 [00:39<0
```

5. Evaluate and Deploy the model



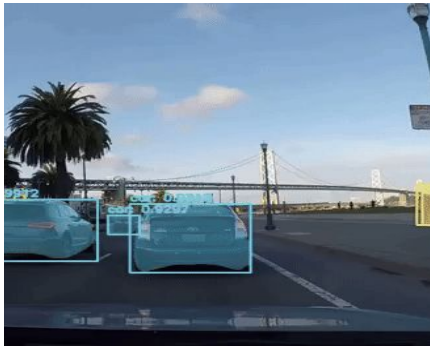
Future applications:

& Infinite possibilities



1.Autonomous Vehicles: we canTrain self-driving cars for object detection and road segmentation.
2.Medical Imaging: we can generate similar labeled medical scans for AI-driven diagnostics.
3.Augmented Reality (AR) & Virtual Reality (VR):
Security & Surveillance
4.Agriculture: we can generate synthetic data tor ai model that Identify crop diseases using AI-powered image segmentation.
5..Robotics
6.Gaming & Animations
7.HealthCare
8.Manufacturing etc..

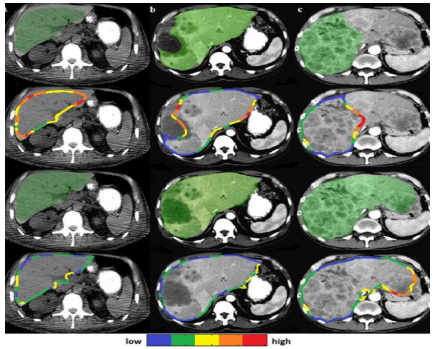
Autonomous Driving



Robotics and vision

Virtual Reality

Healthcare and medicals



Thank You

Oist, Bhopal