

# **Synthetic Data Generation for All Weather Image Enhancement and Object Detection**

## **General Dataset Specifications**

All teams must clearly specify and follow these common requirements:

### **1. Dataset Generation Methodology**

Participants must use publicly available datasets (e.g., Kaggle) containing clear ground-truth images as the reference. Participants must clearly describe how the synthetic images are generated.

The dataset may be created using one or more of the following approaches:

- Algorithmic / Coding-based methods  
(e.g., Python, OpenCV, image processing, physical models)
- Simulation or Smart Tools  
(e.g., Blender, Unity, CARLA)
- Generative Models  
(e.g., GANs, Diffusion Models)

### **2. Dataset Size**

- Minimum 5,000 images per weather category
- Minimum 3 severity levels (e.g., light, medium, heavy)
- Balanced distribution across severity levels

### **3. Image Specifications**

- Resolution: Minimum 640×480 (preferred: 1280×720)
- Format: JPEG
- Color Space: RGB

### **4. Object Classes**

- Minimum 3 object classes (examples: person, car, bike, traffic sign)
- Clearly define class names in a classes.txt file

### **5. Annotations**

- Bounding-box annotations (YOLO / COCO / Pascal VOC – specify format)
- Each image must have:

- ❖ Object class label
- ❖ Bounding box coordinates
- Annotation consistency is critical

## 6. Metadata

Each image must include metadata (Word Document) containing:

- Weather type
- Severity level
- Parameter values used for generation
- Random seed (if applicable)

## 7. Reproducibility

- Clearly describe the pipeline
- Parameter ranges must be documented
- Same input + same parameters → same output

### Problem Statement:

#### 1. Foggy Scene Dataset Generation

Generate a synthetic image dataset of real-world scenes affected by fog or haze, with varying visibility levels.

Requirements:

Separate datasets for light, medium, and heavy fog

Minimum 3 object classes

Bounding-box annotations

Metadata describing fog density

Consider these parameters:

Parameter	Light Fog	Medium Fog	High / Dense Fog
Fog density (normalized)	0.10 – 0.30	0.40 – 0.60	0.75 – 1.00

Parameter	Light Fog	Medium Fog	High / Dense Fog
Extinction coefficient $\beta$	0.02 – 0.05	0.06 – 0.10	0.12 – 0.25
Visibility distance (m)	60 – 150	30 – 60	10 – 30
Atmospheric light (A)	0.70 – 0.85	0.80 – 0.90	0.85 – 0.98
Depth range (m)	5 – 200	3 – 120	2 – 60
Weather severity score (0–10)	2 – 4	5 – 7	8 – 10

### Final Deliverables

Teams must submit:

1. Dataset (images + annotations)
2. Metadata files
3. README explaining setup and usage
4. Sample visualization results
5. Technical report (PDF, max 10 pages)