



Assessment: Image Processing (AI/ML) – Intern

Hello,

Greetings of the day!

There are ground-based telescopes dedicated to capturing images and tracking "space objects," i.e., satellites/ space debris. These space objects & stars are visible as streaks/lines and spots/points against the dark/noisy background, respectively.

As an Image Processing (AI/ML) – Intern, you are tasked with developing a robust model to detect and classify objects/stars. The model should be well-trained and thoroughly tested to ensure high accuracy when validated against diverse datasets. Consider the project described above, please answer the following.

Question 1:

Develop an **ML/DL model (Preferably CNN)** to detect and classify the **streaks/lines** and **stars/spots** using the synthetic images provided in the zip file.

- A1: Detect streaks and stars and obtain the respective centroid coordinates.
- A2: Classify the streaks and stars with appropriate annotations.
- A3: Mention the training/testing accuracy along with the computation time of the model.

The typical parameters of the simulated images given are as follows:

- Image dimension: 4418 x 4418 pixels.
- Data type: 16-bit unsigned integer.
- Band: Singleband (grayscale)

Note: The dataset consists of 35 raw images stored in Datasets_Assessment.zip, which must be used for model training and testing. Reference images are provided only for visual inspection of streaks and stars. Please use the google drive link mentioned below for accessing the datasets.

<https://drive.google.com/drive/folders/1AqrixSQ7VLfR5aMmq4HIg0OLqKEbFaUh?usp=sharing>



Question 2

The model developed in question 1 needs to be implemented to detect streaks and stars in real-sky images captured by ground-based telescopes. Please answer the following questions with clear reasoning in the above context.

- a) How can the model achieve high accuracy when the available training images are insufficient? What strategies can be used to overcome this limitation?
- b) How can model overfitting and underfitting be addressed? What factors contribute to these issues?
- c) Can the developed model accurately detect streaks and stars in real-sky astronomical images, given varying signal-to-noise conditions (e.g., faint object detection)? How does this differ from simulated images?
- d) What is the likelihood of false detections, such as detecting multiple blobs along a streak instead of a continuous line? Will the model correctly report false positives and generate an appropriate error matrix?

Note:

- Send the response as a zip file with clear instructions on how to open the file.
- Share the developed model and algorithm through GitHub/git repository if possible.
- State assumptions at the relevant sections.
- Avoid generic answers.
- Provide the response within four pages, excluding the source code and support files.



Fig.1: Sample raw image

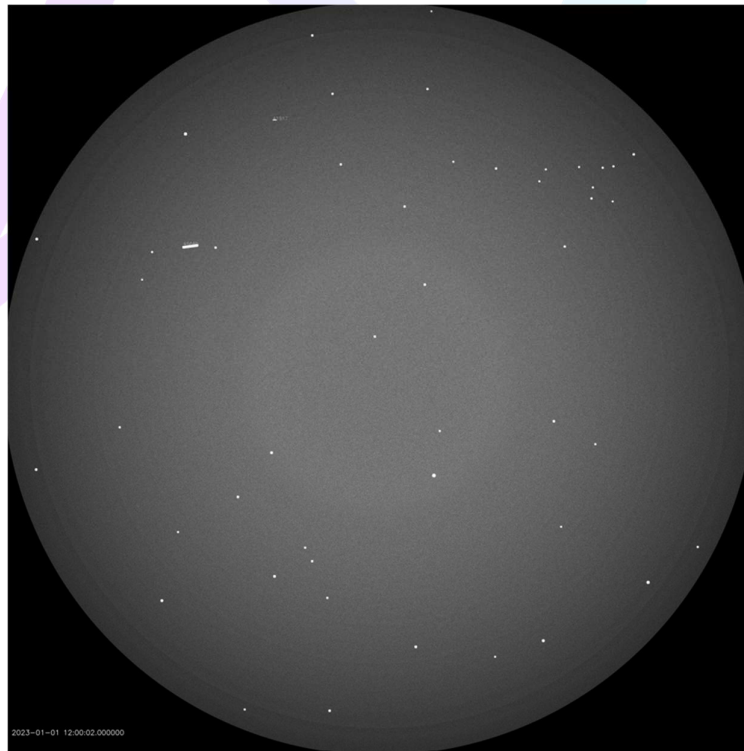


Fig.2: Reference image of the raw image shown in Fig.1