Evaluation of the Rocket's Behavior based on Image Recognition Technology

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Abstract

It is important to analyze the position and attitude of a rocket, immediately after the lift-off. This data is used for the evaluation of a rocket's displacement caused by a surface wind, or a clearance between a rocket and a launcher. However, through the actual launch operation, this behavior can be measured only by "Indirect" approaches, for example numerical analysis or on-board avionics. Therefore, we have developed the new system based on image recognition technology, which can evaluate the behavior"Directl", and improve the designs and operations of both rockets and launchers. This research focuses on develop the fundamental technology of the new system.

Reasons and benefits of using JAXA Supercomputer System

For the calculation of the rocket's position and attitude, by using image processing technology, following 3 processes are required: (1) take two images at the same time, (2) detect rockets and identify its key-points from each image, and (3) calculate triangulation for defining the rocket's 3D position, as shown in Fig, 1. Deep learning models are applied for the process (2), and they consist of the model to detect rocket and the model to identify key-points. We utilized the JSS3 for train the deep learning models and succeed to complete the large-scale training calculation rapidly and efficiently.

Achievements of the Year

By utilizing JSS3, the deep learning models for the rocket detection and the key-point identification could be finally constructed, and the rocket position is calculated as shown in Fig. 2. In addition, rocket's position data, which is more fluent and certain than the result of last year, can be obtained from the analysis. As a result of the research in this year, we can build the foundation of the technologies, and this can be applied to other rockets.

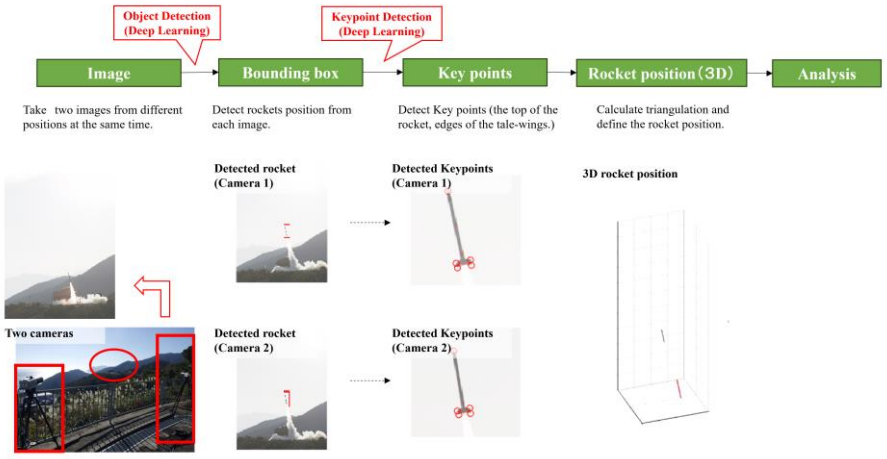

Fig. 1: The process of detecting a rocket position

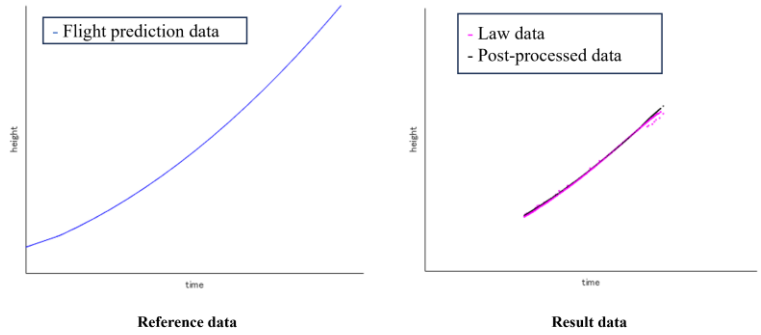

Fig. 2: Evaluated roclet position

- **Publications**

  N/A

- **Usage of JSS**

- **Computational Information**

Process Parallelization Methods	N/A
Thread Parallelization Methods	N/A
Number of Processes	1
Elapsed Time per Case	4 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.00

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	0.00	0.00
TOKI-ST	284.14	0.00
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	0.00	0.00
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2] (%)
/home	0.00	0.00
/data and /data2	2,133.33	0.01
/ssd	0.00	0.00

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2] (%)
J-SPACE	0.00	0.00

[*1]: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage[*2] (%)
ISV Software Licenses (Total)	0.00	0.00

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.