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# Development of the grade selection of X-ray events using machine learning for a CubeSat application

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X-ray observation covering a wide field of view with a high sensitivity is essential in searching for an electromagnetic counterpart of gravitational wave events. A combination of Lobster-eye optics (LEO) and a large-area CMOS sensor is an ideal instrument to achieve this goal. Furthermore, thanks to the light weight of LEO, it can be installed on a small platform such as a CubeSat.
SEAGULL is a future 3U CubeSat mission for searching the electromagnetic counterpart of gravitational waves in the soft X-ray band (0.4 ~ 4 keV) [1]. As the X-ray detector in the SEAGULL, a back-illuminated CMOS image sensor, GSENSE4040BSI, with 4096×4096 pixels fabricated by Gpixel Inc is a good candidate. We conducted an experiment for the spectroscopic performance, and the X-ray lines of Mn-Kα (5.9 keV) and Mn-Kβ (6.4 keV) were clearly detected.
However, the real-time identification of X-ray events is challenging with restricted resources. Therefore, we use one of the machine learning models for a convolutional neural network (CNN) to extract X-ray events in the image taken from a CMOS sensor. Moreover, we use a Sony microcontroller board, Spresense, that provides ultra-low power consumption and supports machine learning libraries for the process. This paper introduces our machine learning-based X-ray event selection process that is targeted for use on a CubeSat.

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