

Master Thesis Work

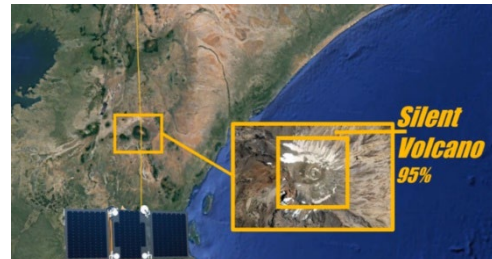
of Choose title

Trainingsbilder-Generator für die IceBrain-1 Bilderkennung KI

Training Image Generator for the IceBrain-1 Image Recognizer AI

Motivation:

Luleå University of Technology is heading to fly a series of AI in-orbit image recognition missions based on GOMSpace CubeSats. The system consists of a camera with large focus-length optics, an Instrument control Unit (ICU) and a reference AI image processor as well as a high performance GPU/FPGA processor. To train the image recognition algorithms before flight and later in flight to improve their performance, they need to be fed with a large amount of training image material and known recognition results. For this purpose an initial training image generator shall be implemented in Python. The image generation shall be based initially on Google Earth images and their artificial variation



Task description of the thesis work:

- Familiarize with Google Earth and generation of images of a reference resolution. The initial source image shots need to be taken in 8k Resolution.
- Familiarize with the Python Image Library PIL. For purpose of automating the latter process, the image generator has to be implemented in Python and/or toolkits like OpenCV.
- Implement in PIL a function to center at a selectable position a 4096x3000 pixel frame inside the 8k original (7680x4320 pixels) and a crop/save-function to store the cutout under an automatically generated reference name. For visualization a 4k Monitor is sufficient.
- Implement a function to generate statistically differently positioned sub-selections/crops/cutouts.
- Implement a function to generate automatically rotated cutouts in 4096x3000 pixel resolution.
- Analyze the complexity to implement a cloud simulation by artificially (automatedly) place whitened areas in the image.
- Document the use of your image generator and the code for further enhancements.

The thesis will be accomplished at IRS, Uni Stuttgart.

Internal supervisor: Hon. Prof. Dr. Jens Eickhoff

External supervisors: Prof. Dr. René Laufer

Starting date: 01.07.2024

Submission until: 31.12.2024

Acknowledgement of receipt:

I hereby confirm that I read and understood the task of the master thesis, the juridical regulations as well as the study- and exam regulations.

 Date
 Prof. Dr.-Ing. Sabine Klinkner
 (Responsible Professor)

 Date
 Prof. Dr. René Laufer,
 Ext. Supervisor: Luleå University of Technology

 Date
 Signature of the student

Legal Restrictions: The author/s of the bachelor thesis is/are not entitled to make any work and research results which he/she receives in the process of writing this thesis accessible to third parties without the permission of the named supervisors. The author/s shall respect restrictions related to research results for which copyright and related rights already exist (Federal Law Gazette I / S. 1273, Copyright Protection Act of 09.09.1965). The author has the right to publish his/her findings as long as they incorporate no findings from the supervising institutions and companies for which restrictions exist. The author must consider the rules and exam regulations issued by the university and faculty of the branch of study where the bachelor thesis was completed.

IRS Professors and Associate Professors:

Prof. Dr.-Ing. Stefanos Fasoulas (Managing Director) · Prof. Dr.-Ing. Sabine Klinkner (Deputy Director) ·
 Hon.-Prof. Dr.-Ing. Jens Eickhoff · Prof. Dr. rer. nat. Reinhold Ewald · apl. Prof. Dr.-Ing. Georg Herdrich · Prof. Dr. rer. nat. Alfred Krabbe ·
 Hon.-Prof. Dr. Volker Liebig · Hon.-Prof. Dr. rer. nat. Christoph Nöldeke · Prof. Dr.-Ing. Stefan Schlechtriem · apl. Prof. Dr.-Ing. Ralf Srama

Declaration

I, **Name, First name** hereby certify that I have written this **please select a topic** independently with the support of the supervisor, and I did not use any resources apart from those specified. The thesis, or substantial components of it, has not been submitted as part of graded course work at this or any other educational institution.

I also declare that during the preparation of this thesis I have followed the appropriate regulations regarding copyright for the use of external content, according to the rules of good scientific and academic practice¹. I have included unambiguous references for any external content (such as images, drawings, text passages etc.), and in cases for which approval is required for the use of this material, I have obtained the approval of the owner for the use of this content in my thesis. I am aware that I am responsible in the case of conscious negligence of these responsibilities.

.....
Place, Date, Signature

I hereby agree that my **please select a topic** with the following title:

Enter title

is archived and publicly available in the library of the Institute of Space Systems of the University of Stuttgart **without blocking period** and that the thesis is available on the website of the institute as well as in the online catalogue of the library of the University of Stuttgart. The latter means that bibliographic data of the thesis (title, author, year of publication, etc.) is permanently and worldwide available.

After finishing the work, I will, for this purpose, deliver a further copy of the thesis along with the examination copy, as well as a digital version.

I transfer the proprietary of these additional copies to the University of Stuttgart. I concede that the thesis and the results generated within the scope of this work can be used free of cost and of temporal and geographical restrictions for the purpose of research and teaching to the institute of Space Systems. If there exist utilization right agreements related to the thesis from the institute or third parties, then these agreements also apply for the results developed in the scope of this thesis.

.....
Place, Date, Signature

¹ Stated in the DFG recommendations for „Assurance of Good Scientific Practice “or in the statute of the University of Stuttgart for „Ensuring the Integrity of Scientific Practice and the Handling of Misconduct in Science “