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2019


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26. - 28. 8. 2019
SPACE::LAB - Bulharská 4, Košice
Téma: Machine learning and Space data
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AGU ADVANCING EARTH AND SPACE SCIENCE

JGR Space Physics

TECHNICAL REPORTS: METHODS

10.1029/2020JA028991

Data-Driven Modeling of Atomic Oxygen Airglow over a Period of Three Solar Cycles

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Key Points:

- A data-driven model is able to represent complex physical phenomena
- Advanced machine learning techniques are effective for the development of the data-driven model
- Developed data-driven model visualizes airglow hourly intensities over a 30-year period for Abastumani (41.75 N, 42.82 E)

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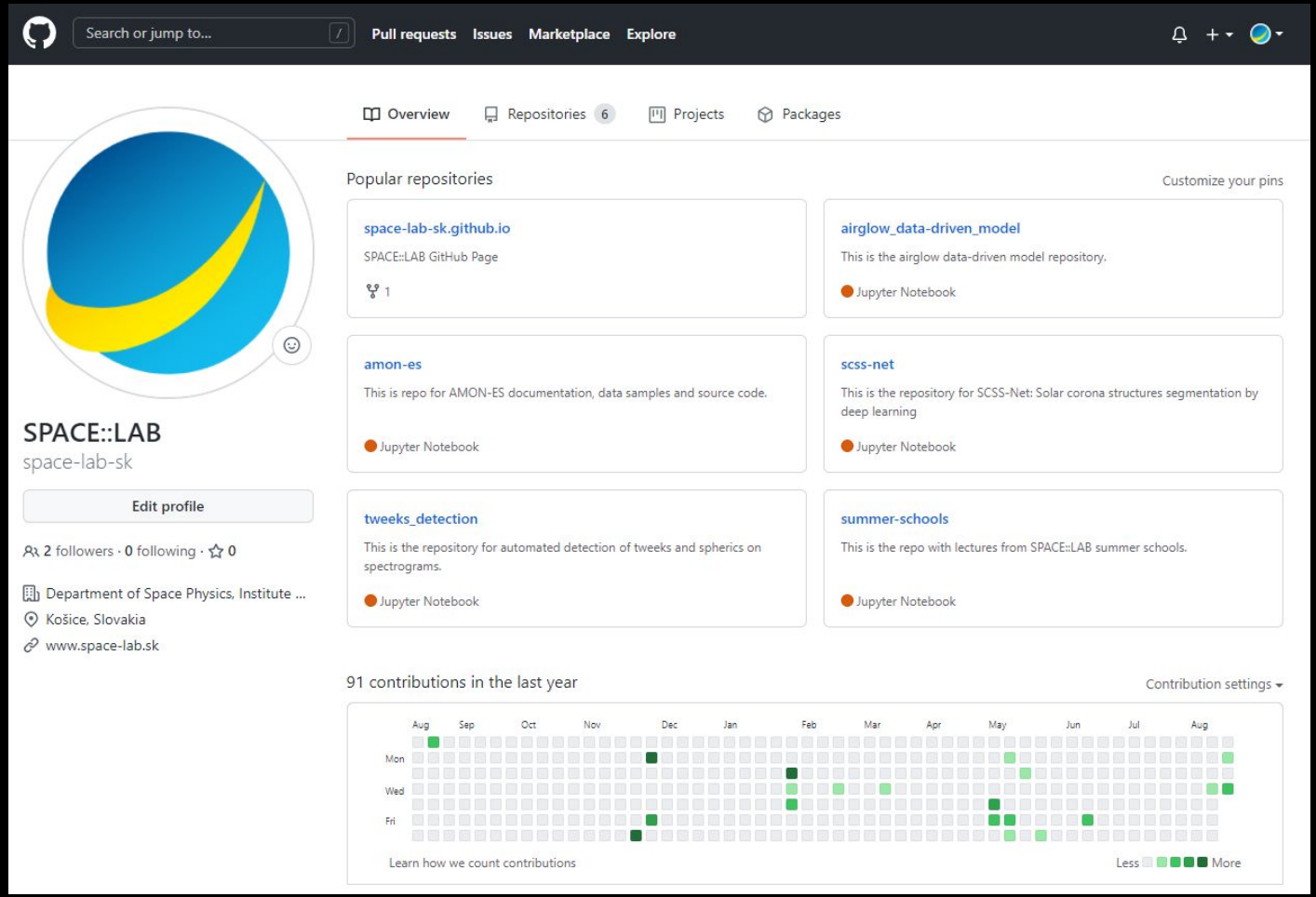
Abstract The Earth's upper atmosphere is a dynamic environment that is continuously affected by space weather from above and atmospheric processes from below. An effective way to observe this interface region is the monitoring of airglow. Since the 1950s, airglow emissions have been systematically measured by ground-based photometers in specific wavelength bands during the nighttime. The availability of the calibrated data from over 30 years of photometric airglow measurements at Abastumani in Georgia (41.75° N, 42.82° E), at wavelengths of 557.7 and 630.0 nm, enable us to investigate if a data-driven model based on advanced machine learning techniques can be successfully employed for modeling airglow intensities. A regression task was performed using the time series of space weather indices and thermosphere-ionosphere parameters. We have found that the developed data-driven model has good consistency with the commonly used GLOW airglow model and also captures airglow variations caused by cycles of solar activity and changes of the seasons. This enables us to visualize the green and red airglow variations over a period of three solar cycles with a one-hour time resolution.

1. Introduction

The Earth's upper atmosphere acts as an interface between processes in space and on Earth. It is a very dynamic environment continuously influenced by solar radiation and space weather from above and by

https://github.com/space-lab-sk



MNRAS 000, 1–11 (2021) Preprint 18 August 2021 Compiled using MNRAS LATEX style file v3.0

SCSS-Net: Solar Corona Structures Segmentation by Deep Learning

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Accepted XXX. Received YYY; in original form ZZZ

ABSTRACT

Structures in the solar corona are the main drivers of space weather processes that might directly or indirectly affect the Earth. Thanks to the most recent space-based solar observatories, with capabilities to acquire high-resolution images continuously, the structures in the solar corona can be monitored over the years with a time resolution of minutes. For this purpose, we have developed a method for automatic segmentation of solar corona structures observed in EUV spectrum that is based on a deep learning approach utilizing Convolutional Neural Networks. The available input datasets have been examined together with our own dataset based on the manual annotation of the target structures. Indeed, the input dataset is the main limitation of the developed model's performance. Our *SCSS-Net* model provides results for coronal holes and active regions that could be compared with other generally used methods for automatic segmentation. Even more, it provides a universal procedure to identify structures in the solar corona with the help of the transfer learning technique. The outputs of the model can be then used for further statistical studies of connections between solar activity and the influence of space weather on Earth.

Key words: Sun: corona – methods: data analysis – techniques: image processing – software: development

1 INTRODUCTION

Solar activity has been quantified using various indices such as the sunspot number (Clette et al. 2014), the F10.7 index (Tapping 2013), coronal index (Rybanský et al. 2005), and others (Ermolli et al. 2014) over more than six decades. These indices represent integrated quantities for specific processes in the solar atmosphere as they are measured by ground-based instruments. Thanks to the most

rithms were introduced. The Spatial Possibilistic Clustering Algorithm (SPoCA) (Barra et al. 2009; Verbeeck et al. 2014) or Coronal Hole Identification via Multi-thermal Emission Recognition Algorithm (CHIMERA) (Garton et al. 2018) have been found to be very effective and are widely used in online solar data visualization tools[1,2]. The SPoCA also provides entries for catalogues of coronal holes and active regions within the Heliophysics Events Knowledgebase (HEK) (Hurlburt et al. 2012) that is commonly used in the


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Téma: Develop your own Virtual Observatory

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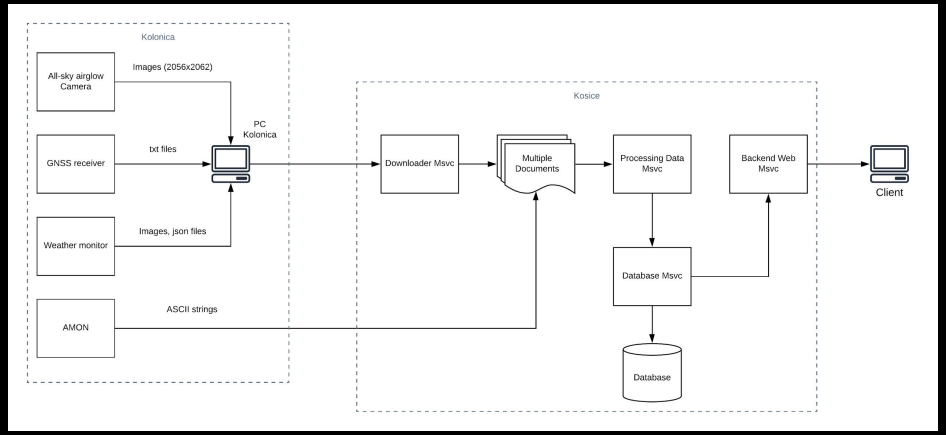
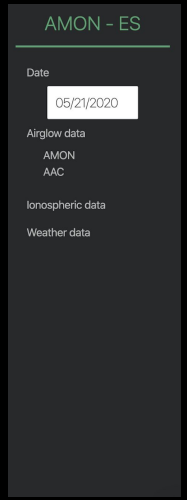
SPACE::GROUP

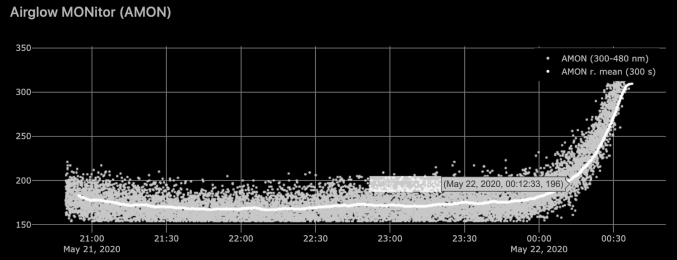
- follow-up of summer school
- Space & IT enthusiasts
- regular meetings and task management
- development of VO for AMON-ES

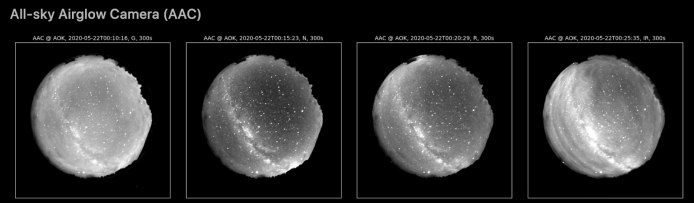


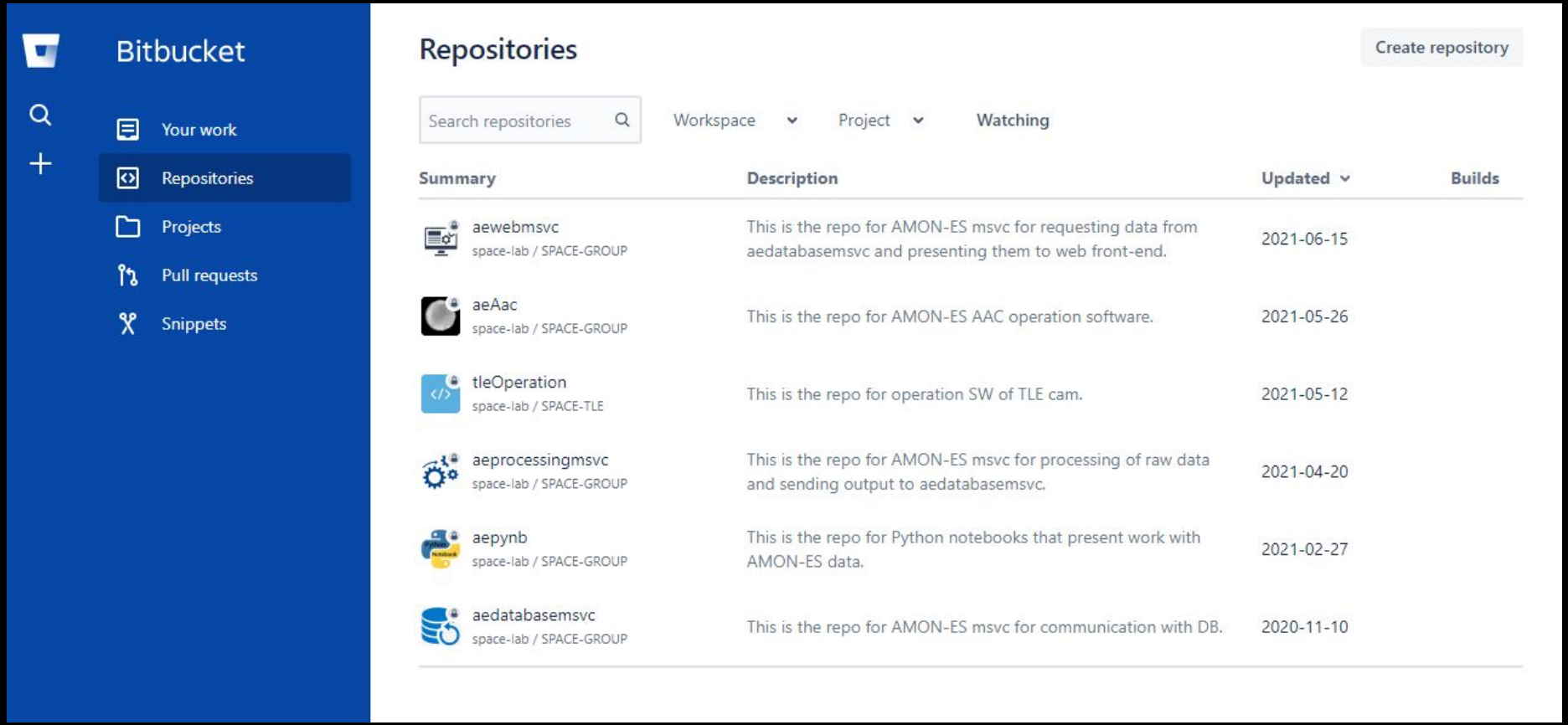
SPACE::LAB summer school 2020 #technologies

Dash by plotly, astropy, Trello, matplotlib, TensorFlow, jupyter, CO, Bitbucket, NumPy, python, slack, pandas, Flask, MySQL, POSTMAN, scikit-learn, PyCharm, Sourcetree, SciPy, Keras








Bitbucket
Your work
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Pull requests
Snippets
Repositories
Create repository
Search repositories
Workspace
Project
Watching
Summary
Description
Updated
Builds
aewebmsvc
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This is the repo for AMON-ES msvc for requesting data from aedatabasemsvc and presenting them to web front-end.
2021-06-15
aeAac
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This is the repo for AMON-ES AAC operation software.
2021-05-26
tleOperation
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This is the repo for operation SW of TLE cam.
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aeprocessingmsvc
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This is the repo for AMON-ES msvc for processing of raw data and sending output to aedatabasemsvc.
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aepynb
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This is the repo for Python notebooks that present work with AMON-ES data.
2021-02-27
aedatabasemsvc
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This is the repo for AMON-ES msvc for communication with DB.
2020-11-10

SPACE::GROUP workshop
29.5.2021

Looking forward to SPACE::LAB summer school 2021 **follow-up**