

## Aerospace Engineer with the focus on Novel Algorithms in Space at the European Space Agency



### Education

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10/01/16 – 02/07/20

**Master of Science in Aerospace Engineering**  
University of Stuttgart, Stuttgart (Germany)

Specialization: Design of Space Systems

Relevant Coursework:

- Spacecraft Technology
- Control and System Design
- Design of Small Satellites
- Satellite Operation
- Reentry Technology
- Satellite Instruments
- System Simulation and System Verification in Satellite Design

- Development of an exploration rover system
- Astronautics and Space Exploration
- Orbit Mechanics for Spacecrafts
- Space Station Design Workshop
- Space Stations, Design, Systems, Utilization
- Experimental Methods of Infrared Astronomy

09/01/12 – 09/30/16

**Bachelor of Engineering in Aerospace Engineering**  
University of Applied Sciences, Bremen (Germany)

Specialization: Space Transportation Systems

Relevant Coursework:

- Computer Science
- Spacecraft Design
- Flight Control

- Mathematics
- Electrical Engineering

### High School Diploma

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2004–2011

School: Gymnasium Ritterhude  
Degree: A-levels

## Work Experience

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03/01/20 – Present

### **Software Engineer (Post Graduate Trainee)**

European Space Agency, ESTEC (Netherlands): Section of On-board Computers and Data Handling in the TEC directorate (Technology, Engineering and Quality)

#### Analysis of Requirements and Hardware Device Survey

- Defined mission types for potential novel algorithm implementations and their requirements (functional, performance, operational, environmental) on the design requirements (application, processing units, interfaces, and radiation mitigation techniques).
- Compared potential hardware architectures and their radiation properties: CPU, FPGA, SoC, GPU, VPU.

#### Investigation of Potential On-Board Algorithms

- Researched Machine and Deep Learning algorithms for on-board processing.
- Analyzed available datasets and models for Machine and Deep Learning applications in space.
- Analyzed large spacecraft instrument datasets, mainly for solar observations.
- Evaluated the availability and compatibility of deep learning frameworks.

#### Development of a Deep Learning Application

- Created a neural network training environment and conducted training and optimization.
- Defined metrics and compared the results of image processing tasks for classical algorithms in contrast to novel techniques.
- Made extensive use of Python, C++, OpenCV, docker, GitLab and data science libraries such as TensorFlow, Keras, NumPy, Pandas, Matplotlib, and Scikit-Learn.

#### Deployment of Deep Learning Applications on Space Hardware

- Analyzed available tools for neural network deployment on space hardware.
- Deployed two applications.
- Setup of laboratory environment for processing boards used: 1. Zynq-7020 SoC, 2. Intel Neural Compute Stick
- Quantized and pruned several network configurations by using the vendor provided software tools Vitis AI and OpenVINO.

#### Project Management and Knowledge Exchange

- Planned and track project schedule and milestones.
- Participate and contribute in meetings and provide advice to, but also learn from European industry, universities as well as internal customers (mostly science teams).

#### Advanced Training

- Participated in the “Ladybird Guide to Spacecraft Operations”, taught by a spacecraft operator at ESOC.
- Participate in a Concurrent Design Facility Study (CDF) to explore lunar caves, which includes two universities, a customer (scientists) and the CDF team.

07/01/19 – 02/07/20

### **Systems Engineer (Master Thesis)**

Airbus Defence & Space, Bremen (Germany): Department of Functional Avionics and GNC

-Title: "Deep Learning for Keypoint Localization and its Application to Object Pose Estimation"

-Goal was to automate the pose estimation of a CubeSat with monocular vision on a robotic arm.

#### Theory for Computer Vision Problems and Introduction to Artificial Intelligence Techniques

-Focused on computer vision problems and how they can be solved with Artificial Intelligence techniques.

-Learned to develop deep neural networks and the generation of training environments.

-Learned about data science libraries, hyperparameter tuning, over- and underfitting, data pre- and postprocessing, and statistical data analysis and metrics.

#### State-of-the-Art Analysis to solve Pose Estimation with Monocular Vision

-Investigated classical approaches.

-Investigated Convolutional Neural Networks (CNNs) and Generative Adversarial Networks (GANs).

-Defined requirements for novel algorithm implementation.

-Chose approach: Supervised learning to localize 2D keypoints with a CNN with subsequent 2D-3D keypoint matching and filtering.

#### Training Data Generation

-Generated large training datasets.

-Created images and their keypoint ground truths by scripting to introduce a variety of lighting conditions, object size variation and keypoint placements on the CubeSat.

#### Training of a Deep Neural Network to Localize Keypoints

-Software and libraries used were Jupyter Notebook, Keras with TensorFlow backend, and OpenCV.

-Adapted network architectures.

-Tuned and optimized hyperparameters.

#### Evaluation of Training Results

-Generated performance metrics for the analysis of large test datasets.

-Compared the performances of different training datasets, network architectures, and hyperparameters.

10/01/18 – 03/31/19

### **System Engineer Intern**

German SOFIA Institute at NASA Ames Research Center, Moffet Field (United States)

-Team: Telescope Controls

-Reviewed control theory, learned about SISO vs. MIMO systems.

-Developed a software in Matlab to analyze the controller stability for the main control loop of the SOFIA telescope.

-Learned Python in a Coursera online class.

-Analyzed vibrational sensor data in Python.

11/01/16 – 08/31/18

**Graduate Research Assistant**

Institute of Space Systems, Stuttgart (Germany)

- Team: Numerical Modelling and Simulations
- Documented an in-house PIC-DSMC code.
- Learned how to code in Fortran.
- Implemented physical models with Fortran.
- Validated newly developed methods.

02/01/16 – 06/30/16

**Bachelor Thesis**

Airbus Defence & Space, Bremen (Germany)

- Title: Sensitivity analysis of orbit parameter in a satellite constellation to monitor mission purposes and performance parameters
- Matlab, STK

06/01/15 – 11/30/15

**System Engineer Intern**

Eagle Flight Research Center at Embry Riddle Aeronautical University, Daytona Beach (United States)

- Team: Development of a fully electric aircraft
- Analyzed aircraft performance parameter.
- Selected hardware for CAN/I2C communication.
- Developed a prototypic pipeline to test different communication protocols.
- Evaluated test results in LabVIEW.

11/01/14 – 04/30/15

**Research Assistant**

University of Applied Sciences, Bremen (Germany)

- Team: student project for the development of an experimental rocket (STERN)
- Development of a thermal model of the rocket with Matlab/Simulink

## Educational Projects

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07/18 – 07/18

**Space Station Design Workshop**

Institute of Space Systems, Stuttgart (Germany)

- Task: Design of a moon station
- Defined communication subsystem requirements.
- Generated link and data handling budgets.
- Developed a 5G communication system on the moon in collaboration with industry experts.
- Generated cost, mass, and power estimations for communication equipment.

10/17 – 02/18

**Design of a Rover**

- Learned about mobile robotic kinematics.
- Designed the on-board electronic system.
- Selected hardware components.
- Integrated sensors (IMU, encoders, temperature).

10/17 – 02/18

**Phase 0 Study-Design of a Small Satellite**

- Designed the on-board communication system.
- Developed the link, data handling, power, and cost budgets.
- Gained experience in leading a team by being the project manager.
- Our team won with the best satellite design out of three teams.

04/17 – 10/17

**Design and test of a waypoint controller**

- Implementation in C++
- Flight tests and evaluation of controller design

04/17 – 09/17

**Phase 0/A Study-Design of a moon rover**

- Design the thermal system

09/14 – 02/15

**FEM project to analyze static and dynamic loads**

- Analysis with Catia, Patran/Nastran

09/14 – 02/15

**Implementation of a satellite tracking function for an antenna**

- Get TLE data
- Command the antenna controller in LabVIEW

03/14 – 09/14

**Design and construction of a small aircraft**

- Calculate aerodynamic properties
- Design of the avionics
- Component selection
- Construction of the aircraft

## Skills

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### Languages

German: Native | English: Proficient | French: Good | Spanish: Beginner | Dutch: Beginner

### Software/Tools

- Python, C/C++, Matlab, OpenCV, tflite, Vitis AI, OpenVINO, docker, Git, Keras, TensorFlow, and additional data science libraries such as NumPy, Pandas, Matplotlib, and Scikit-Learn
- Cinema 4D, LabVIEW, System Toolkit, Inventor, Catia V5
- LaTeX, MS Office