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Assessing SAR C-band data to effectively distinguish modified land uses in a heavily disturbed Amazon forest

TRILOGY OF VEGETATION INDICES:
Unlocking the Potential to Map Crop Condition with Radar Polarimetry

SAR HELPS MAP VEGETATION IN ECOTONES OF TROPICAL FORESTS

I F O V:
Dr. Masanobu Shimada
Dr. Gopika Suresh
Prof. Michael Schmitt

Featured Images:
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Special Feature on **Sisters of SAR**

Michael Schmitt

IMPORTANT
FOCUSED
OUTSTANDING
VALUABLE

Full Name: Michael Schmitt
Current Position: Professor for Applied Geodesy and Remote Sensing
Affiliation: Munich University of Applied Sciences
Research Interests and Expertise: Remote Sensing, Earth Observation, Data Fusion, Applied Machine Learning

Michael Schmitt is a full professor for applied geodesy and remote sensing at the Department of Geoinformatics of the Munich University of Applied Sciences (MUAS). He also works as a consulting senior scientist at the Remote Sensing Technology Institute of the German Aerospace Center (DLR). Due to his habilitation, he has also been an Adjunct Teaching Professor at the Department of Aerospace and Geodesy of the Technical University of Munich (TUM) since March 2019. Before joining MUAS, Michael worked as a senior researcher at Signal Processing in Earth Observation (SiPEO), a joint venture of TUM and DLR. In summer 2016, he was a guest scientist at the Microwave Remote Sensing Laboratory of the University of Massachusetts Amherst.

His technical passion is in the fields of Earth observation and geospatial data science, i.e. he works on the extraction of geospatial information from different kinds of remote sensing data. For this purpose, he uses techniques from fields such as signal/image processing, machine learning or data fusion. For his dataset SEN12MS, which can be used to train deep learning models for the analysis of multi-sensor satellite imagery, he has won the Open Data Impact Award in 2020.

Can you tell us how you started working on radar remote sensing? Who or what inspired you to become a scientist in this field of study?

I started to work on radar remote sensing in 2008, when my studies of geodesy and geoinformation were in their final stages. I was very fascinated by the possibility of creating high-resolution images of the Earth with radar technology, and by the fact that those images could be acquired day and night, no matter if conditions are cloudy or not. Since I majored in photogrammetry, I was even more thrilled to learn that there is a related technique, called radargrammetry, which allows to reconstruct 3D information by forward intersection of range-Doppler observations. Thus, it was clear that I wanted to have my final thesis in this field. I was lucky to be accepted by Prof. Uwe Stilla for this purpose, who also offered me a job as research assistant and PhD candidate directly after my graduation. He has been a career mentor for me ever since.

Can you tell us about your current research? In your own opinion, why is your research important?

After finishing my PhD thesis in radar remote sensing, I adjusted my topic a little bit to the area of data fusion in remote sensing. I am convinced that this is an extremely important topic, as remote sensing consists of many different sensor technologies with different attributes, weaknesses and strengths. This holds in particular for the combination of optical and radar data.

With my research, I am trying to get as much information as possible out of those different data sources, using techniques from methodical fields such as signal/image processing, estimation theory or machine learning. Obviously, this area is very interdisciplinary, and one can cooperate with people from many different fields. [An important paper in this context is https://ieeexplore.ieee.org/document/7740215]

In recent years, artificial intelligence – or better, deep learning – has had an enormous impact on our community, improving classic tasks and enabling innovative new tasks. In this context, I am working on the development of models that allow analyzing remote sensing data independently from the observed scenes – something that is not yet an established standard in remote sensing.

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What is the most interesting project (or research) that you've undertaken as part of your job as a scientist? Can you share with us some of your most memorable experiences or some of what you consider as the highlights of your career?

One highlight certainly was during my PhD studies, when we organized a flight campaign together with the University of Zurich and the Fraunhofer Institute for High Frequency Physics and Radar Technology. The SAR sensor was built into a military aircraft, and due to system constraints (it was an experimental millimeterwave SAR), it had to be flown at an altitude of about 700 m above ground level. Our study scene was the downtown area of Munich. On that day, quite some people called the local police, the press, and (eventually) me because they wanted to know why a big military plane was circling low over the city.

From a more technical point of view, I am thrilled by the possibilities of deep learning-based image-to-image translation – from SAR imagery into (artificial) optical imagery, from cloudy optical data to cloud-free optical data, from single images into digital elevation models etc. These are techniques that at least I could not have imagined 10 years ago.

What are some of the areas of research you'd like to see tackled over the next ten years? How do you envision the progress in radar remote sensing and its potential applications and impacts on society in general?

I'd like to cite Prof. Franz Meyer (University of Alaska Fairbanks) on that one: Like him, I am convinced that we are currently living in the golden age of SAR, with ever more satellites in orbit, private companies building their own systems and offering data and products. Being a bit biased by my research agenda, I think one of the strongest potentials still lies in data fusion, but with a growing focus on time series instead of single-date multi-sensor imagery. With an intelligent combination of SAR and optical satellite image time series, we will more and more be able to provide a quasi-continuous monitoring of our Earth, no matter if it is aiming at our environment or critical tinfrastructure.

I think one of the strongest potentials still lies in data fusion

What are some of the biggest challenges you face as a scientist in your field? Are there any common misconceptions about this area of research?

Frankly speaking, I think right now the biggest challenge is that with more and more open remote sensing data being available, and with deep learning techniques at everyone's disposal, the competition in the scientific community has become much harder than it used to be in remote sensing, when having exclusive access to data already made half the next publication. Now, you have a good idea, and before you turn around, somebody has published something similar. But of course, this makes it also exciting!

What lessons or words of wisdom would you like to pass along to students and young researchers who are just starting their careers in Radar Remote Sensing?

In the beginning, try to focus! Even a relatively small field such as radar remote sensing covers a wide range of topics, from the hardware and system design via the signal processing algorithms for image focusing and techniques such as InSAR, TomoSAR etc. to modern machine learning approaches for information extraction. If you are just starting, you cannot cover everything, so I think it's best to first become an expert in one topic, and then broader your skill set later.

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