

## Dr Steven Reece: Accelerating the exploitation of Earth Observation data through Machine Learning (2018-2021)

Dr Steven Reece is a Senior Research Associate at University Oxford in the Department of Engineering Science. His research involves developing novel techniques and computer software for finding patterns in data, combining multiple sources of data, and correcting errors in data. Steven applies his expertise in data analytics to disaster management and conservation applications.

Steven worked as a Researcher in Residence at Satellite Applications Catapult to identify opportunities to work with commercial partners on novel applications of machine learning (ML) and artificial intelligence (AI). AI and ML have huge potential for projects that use satellite data, particularly when the resulting information is required with low-latency and high-cadence. It can provide a cost-effective solution to generating geospatial intelligence, which includes disaster management applications where they can analyse huge volumes of information produced immediately after an event by non-specialist volunteers.

During the RiR, for EASOS's Marine Watch application, Steven developed a tool to model the dispersion of an oil slick backwards in time. Combined with vessel tracking data, this will enable government agencies to identify the most likely polluter, leading to increased fines and potentially reducing the number of polluting incidents by acting as a deterrent. This RiR programme also had projects which received significant interest from commercial and non-governmental organisations, specifically around wide-area satellite imagery analysis, asset mapping, identifying natural hazard threats to infrastructure and also mapping habitat loss and threats to bio-diversity.

Combining the commercial and developmental expertise of the Satellite Applications Catapult with Steven's technical expertise and other partners led to several successful joint funding bids to the UKSA, Innovate UK and private funders.

Links to thought pieces:

- RiR week post: <https://sa.catapult.org.uk/blogs/rir-week-mapping-terrestrial-objects-in-satellite-imagery-with-machine-learning/>
- EASOS Marine Watch: <https://www.riskaware.co.uk/wp-content/uploads/MarineAware-Case-Study-Marine-Watch-Johor.pdf>
- Data Scientists to the Rescue: <http://www.ox.ac.uk/research/research-impact/data-scientists-rescue>
- Rescue Global: <https://theconversation.com/heres-how-citizen-scientists-assisted-with-the-disaster-response-in-the-caribbean-85418>
- Sean O'Neill: A Machine Learning Revolution in Disaster Response <https://www.turing.ac.uk/research/impact-stories/machine-learning-revolution-disaster-response>
- Balaniuk, Remis, Olga Isupova, and Steven Reece. "Mining and Tailings Dam Detection in Satellite Imagery Using Deep Learning." *Sensors* 20.23 (2020): 6936. <https://www.mdpi.com/1424-8220/20/23/6936>
- Duporge, Isla, et al., "Using very-high-resolution satellite imagery and deep learning to detect and count African elephants in heterogeneous landscapes." *Remote Sensing in*

*Ecology and Conservation* (2020).

<https://zslpublications.onlinelibrary.wiley.com/doi/10.1002/rse2.195>

- Isupova, Olga, et al., "BCCNet: Bayesian classifier combination neural network", NeurIPS workshop Machine Learning for the Developing World, best paper, 2018.  
[https://arxiv.org/abs/1811.12258?utm\\_source=feedburner&utm\\_medium=feed&utm\\_campaign=Feed%253A+arxiv%252FQ5Xk+%2528ExcitingAds%2521+cs+updates+on+arXiv.org%2529](https://arxiv.org/abs/1811.12258?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%253A+arxiv%252FQ5Xk+%2528ExcitingAds%2521+cs+updates+on+arXiv.org%2529)