Research on Effective Remote Sensing Image Processing Technologies and Methodologies for Oil Spill Monitoring

European PI(s)
Prof. Jon Atli BENEDIKTSSON, benedikt@hi.is
Dr. Ferdinando NUNZIATA, ferdinando.nunziata@uniparthenope.it

Chinese PI(s)
Dr. WEI Yongliang, yl-wei@shou.edu.cn
Prof. CHI Mingmin, mmchi@fudan.edu.cn

The proposed research is the first attempt to transfer single- and multi-polarimetric space borne SAR and multi/hyperspectral images from different locations for oil slicks detection and then to implement it under high performance computing architectures: field programmable gate arrays (FPGAs) and graphical processing units (GPUs).

The importance of this research project is twofold: On a scientific side, the project will design and test robust classification, knowledge transfer, data fusion and change detection algorithms for the analysis of SAR data, multi/hyper-spectral optical data from different locations for oil slicks detection and tracking; On an applicative side, the project will contribute in promoting new value-added remote sensing applications aimed at ECS monitoring. All the proposed algorithms will be used for worldwide oil slicks detection and tested at the SOA oil spill response centre in Shanghai, China.

To pursue the project goals, Single Look Complex (SLC) ENVISAT-ASAR and ALOS PALSAR L-band SAR data acquired in single-polarization or polarimetric mode, HJ-1A/1B hyperspectral and multispectral data, new acquisitions of EO-1 Hyperion data, are needed.

The proposed project allows exploiting optical and/or SAR products for research and development of applications for Earth Observation (EO). The project rationale lies on a deep co-operation between Chinese and European (including Icelandic, Italian and Spain) partners. Moreover, young faculty members and graduate students will actively take part in the modelling and the development of machine learning and image processing techniques for oil detection as well as oil slicks trajectory prediction by integrating both SAR and optical data.

Since the main objective of the proposed project is demonstrating the benefit of optical and/or single- and dual-polarimetric SAR products in observing oil slicks and simulation of the trajectory of actual oil slick, three thematic Dragon-3 areas are covered: "Hazards", “Oceanography” and “Method”. These applications are of importance to both scientific and the operational oil spill response communities. Our proposed research will deliver the following results:

- Promoting an "intelligent", i.e. physically-based, use of remotely sensed measurements for generating added-values products: oil slicks detection map.

- Promoting the co-operation between Chinese and European partners by taking full advantage of their respective expertise.

"龙计划"三期项目执行摘要 ID.10689

用于溢油监测的高效遥感图像处理技术和方法研究

欧方项目负责人： Prof. Jon Atli Benediktsson, benedikt@hi.is
Dr. Ferdinando Nuznziata, ferdinando.nunziata@uniparthenope.it
中方项目负责人： 魏永亮博士, yl-wei@shou.edu.cn
池明旻教授，mmchi@fudan.edu.cn

本项目将首次尝试利用不同地点的星载合成孔径雷达（SAR）单极化和多极化图像以及多光谱/高光谱图像，进行溢油检测研究，并在高性能计算体系中实现该功能，如采用现场可编程逻辑门阵列（FPGAs）和图形处理器（GPUs）。

本研究项目重要性体现在以下两点：科学层面上，本项目将针对不同地点的合成孔径雷达以及多光谱/高光谱光学数据，设计并测试鲁棒的分类算法、知识转移方法、数据融合技术以及变化检测算法等以进行溢油检测和追踪；应用层面上，本项目将致力于推动新的溢油监测增值遥感应用。所有提出的算法将用于全球溢油检测并在国家海洋局东海预报中心进行测试。

为实现本项目目标，需要以下数据：ENVISAT-ASAR的单视复数据（SLC）、L波段ALOS/PALSAR的单极化或多极化数据、HJ-1A/1B多光谱和高光谱数据和EO-1 Hyperion数据。

本项目将采用光学和/或SAR产品数据用于地球观测（EO）应用的研究开发。本项目立题依据在于中国和包括冰岛、意大利和西班牙在内的欧洲各国间的深层次合作。另外，年轻教师和研究生将积极参与到整合SAR和光学数据进行溢油检测的模型设计、机器学习和图像处理技术的开发以及溢油轨迹的预测。

本项目的主要目标在于论证利用光学和/或单极化和多极化SAR产品进行溢油观测和轨迹模拟的优势，将涉及"龙计划3"的三个主题领域："灾害"、"海洋学"以及"方法论"。这些应用对于科学的和业务化的溢油响应领域都很重要。我们的研究将提供以下结果：

*促进"智能化"，即以物理为基础、利用遥感测量结果生成的增值产品：溢油检测图；

*通过利用各自的专业技能，促进中欧合作者之间的合作。