Remote oil spill detection and monitoring beneath sea ice

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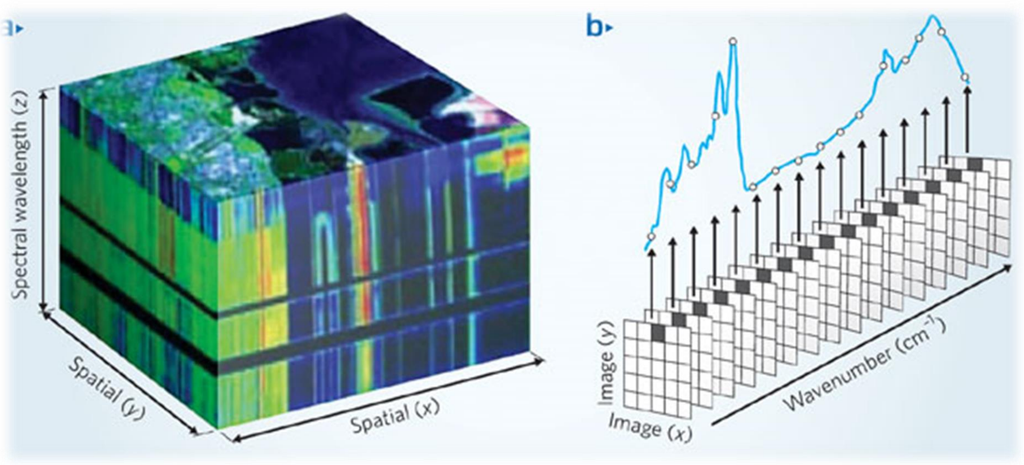
Oil spill in ice affected waters

- The spillage of oil in Polar Regions is particularly serious due to the threat to the environment and the difficulties in detecting and tracking the full extent of the oil seepage beneath sea ice.
- Currently oil which has been spilt in the ice affected water, tends to disappear beneath the ice and it is not possible to detect and monitor where it has travelled or at which point it will emerge from the edge of the ice into open sea.
- Development of surface based technology which can rapidly scan large areas of ice and detect the oil spill underneath is highly desirable.



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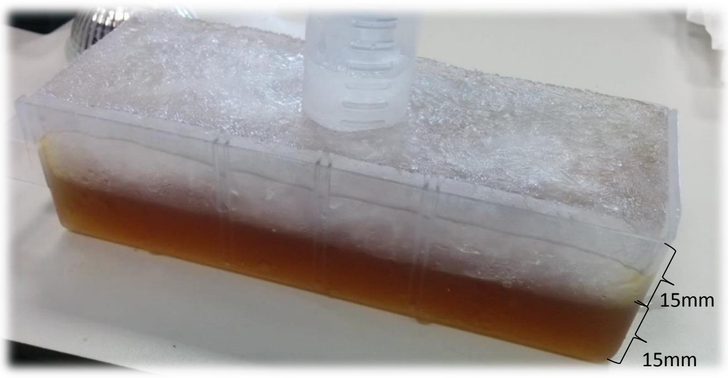
Hyperspectral Imaging

- Hyperspectral data cube is a stack of images, captured at hundreds of wavelength bands, in which each pixel (vector) is represented by a spectral signature that characterizes the underlying objects
- Set of signal processing techniques is able to classify captured objects based on their spectral signatures
- This technology is proven for oil spill detection in open water but not yet beneath the ice.
- Variety of hyperspectral imagers is available on the market, characterised by different scanning methods and spectral ranges.

Oil & Ice sample

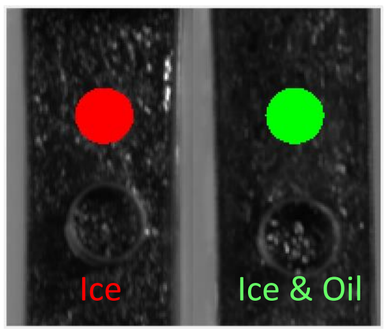
- Small container with 15 mm of ice grown from sea water

- 15 mm of engine lubrication oil introduced beneath this ice surface



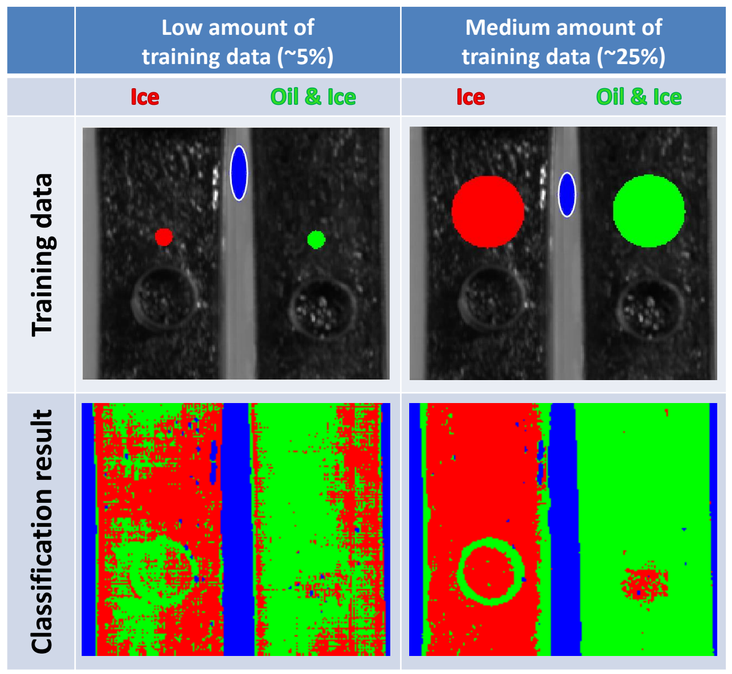
Spectral response

- Plot of spectral signatures of pure ice (red) and ice with oil layer underneath (green) captured with passive NIR system
- Spectral signatures were extracted as an average value from the region marked with the circle on the intensity image.



Classification result

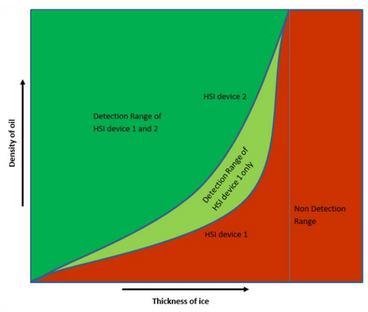
- Colour representation of classification result for pure ice and ice with oil underneath, with various amount of training data



- HSI empowered by signal processing is able to distinguish pure ice from oil under thin ice layer

Future work

- Two different HSI technologies – passive NIR camera and laser based, active Mid-IR system – will be assessed for this task and their capabilities and limits for oil spill detection beneath sea ice will be explored.
- Funding for this study was granted by The International Tanker Owners Pollution Federation Limited (ITOPF)



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