SPECCHIO for Australia: taking spectroscopy data from the sensor to discovery for the Australian remote sensing community

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SPECCHIO for Australia: taking spectroscopy data from the sensor to discovery for the Australian remote sensing community

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Field and laboratory spectroscopy is a common method applied by different remote sensing user communities for various purposes, ranging from essential airborne and satellite calibrations, to parameterising image processing models and validating image based products that map earth surface properties and processes (Milton 2009; Haest, et al. 2013). In all cases a large number of spectra tend to be collected, yet the value and ability to share and confidently re-use such collections is often restricted because the data are stored in disparate silos with little, if any, consistency in formatting and content, and most importantly, lack metadata to aid their discovery and re-use. These datasets have significant potential to benefit the wider earth observation remote sensing and other earth science communities as
well as to contribute to international spectral libraries to fill existing gaps in collections. Until now there has been no consistent method in Australia or internationally for publishing, discovering and accessing this data. An international group of experts attending a TERN ACEAS (Terrestrial Ecosystem Research Network Australian Centre for Ecological Analysis and Synthesis) workshop on best practices associated with bio-optical data in June 2012, established that the existing SPECCHIO system (Hueni et al. 2009) is the most suitable standard for spectral data exchange and should adopted as the system of choice for further development.

Spectral databases, including digital number, radiance, irradiance, absorption and reflectance data, provide the means to store data in an organised manner, described by appropriate metadata, thus containing all of the information necessary for others to assess if the data are suitable for their use and to process the data. This information includes details on how the data were collected – sampling setup as well as the sampling conditions, processed, stored, licensed and conditions for use (Hueni et al. 2011). Such systems enable: (a) long-term consistent standards formats for storage of spectral data and metadata; (b) the retrieval of existing spectral data using metadata space queries; (c) the provision of provenance and hence a repeatability of data processing; (d) a platform not only for mere data storage but also for streamlined processing and generation of information; and (e) the ability for the meta-data to be located and discovered by a range of meta-data search and retrieval processes internationally. A spectral database with associated, intelligent software is thus serving as a spectral information system (Herold, 2003). Spectral information systems take spectral databases a step further by making data held by the databases retrievable and usable by other users or systems and by adding processing functionalities that further transform the data or information held by the system, in turn generating more information. This could e.g. involve the generation of higher-level products or spectral data corrected for sampling equipment or sensor artefacts (Hueni et al. 2012). In the case of the Australian remote sensing community, it was envisaged to develop not just a data repository for spectroscopy data, but instead, to move towards a system that could support scientists in analysing their data using the full potential of combined metadata spaces (Wason and Wiley, 2000) and spectral spaces (Hueni et al 2012).
Based upon extensive stakeholder consultation, feedback, and testing, a central spectral database for Australia has been established and the SPECCHIO code revised to accommodate a change in architecture to a web-based application whilst retaining administrative control via a desk-top (Figure 1). The system incorporates features such as: a metadata standard to improve interoperability and data sharing; links to best practice guidelines; spatial search capabilities; mechanisms to house validation data associated with spectra; and additional enhancements which facilitate ease-of-use. In addition, it has links to other existing national and/or discipline-specific database systems, for example, the TERN Auscover repository, which houses satellite image data and associated field validation data. The link to other repositories also enables the database to be discoverable through national and international meta-data portals and searches. The new SPECCHIO version is now deployed as a spectroscopy database adapted for the Australian remote sensing and earth sciences.

communities to meet common needs of data and metadata storage linked to best practice protocols.

This paper will feature the process undertaken in the development of the Australian version of SPECCHIO, along with an explanation of the new features available and case studies from operational testing which highlight the capacity of the system to capture and manage an expanding range of spectroscopy research data. As the basis of a spectral information system, it is delivering a benefit to the end users by greatly improved management of existing and new data, increased data quality by applying algorithms to a centralised and well-defined data pool and quicker acquisition to product/publication cycles. The newly structured and enhanced version of SPECCHIO can serve as a potential model for international adoption.

Bibliography


