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Creating researchers of the future using freely accessible tools

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Content

Activity undertaken

01

Activity undertaken

New cloud-computing enhanced tools for the rapid analysis of satellite imagery have been developed with the purpose of (a) enabling research standard analysis to be undertaken at unprecedented speed, and (b) as educational tools where students can easily visualise rapid environmental changes that have occurred anywhere on the planet over the last 40 years.

Both undergraduate and researchers can find satellite imagery to be extremely cumbersome to work with irrespective of their level of expertise. File sizes for each image can be >1GB, which then needs to be processed to transform it into a usable image. Consequently, it can take a competent user up to 15 minutes to identify, download and process just one image. The new tools that have been developed at the University of Liverpool leverage cloud computing resources to achieve this in <5 seconds per image.

The intuitive nature of the tools allow students at any level to easily explore volumes of satellite imagery that would normally be prohibitive, even for experts in the field. Their use can help lecturers to easily: contextualise both processes and Earth surface observations that they describe in lectures with real world examples; allow students to freely and easily engage with state of the art cloud-computing based images analysis; and allowing students to explore the feasibility of Earth surface process/observation project topics with ease.

These analyses are relevant for any discipline that may make use of satellite imagery, including both environmental and social sciences.

02

Activity implementation

At present, the tools have been used to enable UG and PGT students to undertake volumes of satellite image analysis that are unprecedented (even in the research community) as part of research projects. The tools has also been incorporated into a formative 2nd year practical assessment where students are first taught how to do ‘traditional’ satellite image processing, before being introduced to the new tools. This allows students to understand how satellite images are processed rather than using the new tools are a “black box”. Students are tasked with generating annotated maps of ‘true colour’ and ‘false colour’ images from satellite acquisitions using traditional approaches, before using the new tools to map Earth surface changes for a location that they identify using the last 40 years of satellite imagery.

03

Programme provision & student experience

Students at UG/PGT/PGR level are all generating research standard analysis at unprecedented scales with relatively minimal training. The tools have been developed in consultation with students, and the intuitive nature of the user interface means that they are generally fully capable users of the tools with less than 15 minutes of explanation.

Online documentation and video walkthrough guides have also been produced allowing students to become users of the tools without extra input from teaching staff.

04

Challenges faced

As the tools were developed at the University of Liverpool, the primary challenge was to take responsibility for making them “user-proof” to prevent the tools from crashing. These problems were overcome through a combination of extensive testing by myself and voluntary testing by Liverpool PGR students and collaboration partners.

05

Liverpool Curriculum Framework

Research-connected teaching

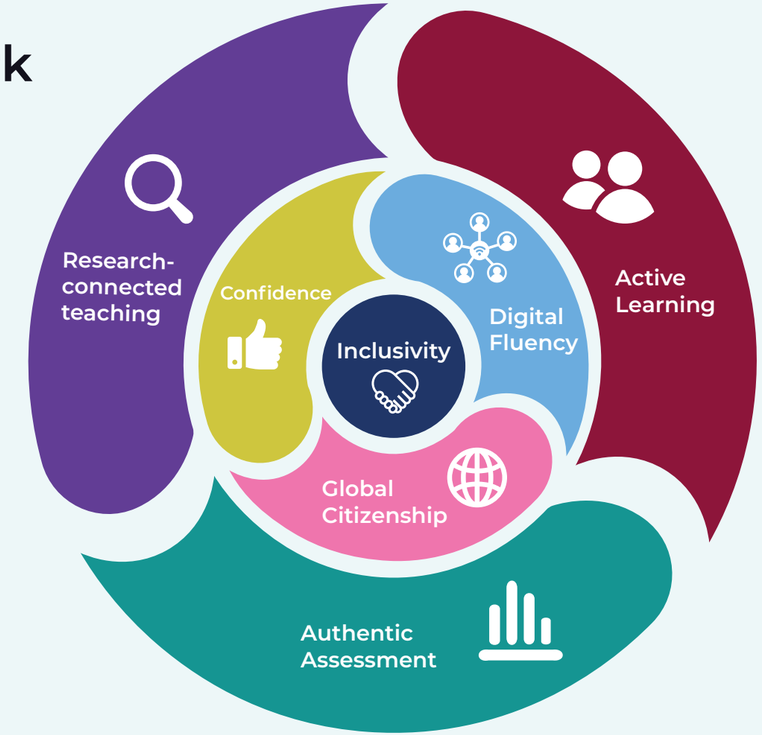
Feeds current research into the syllabus, develops students' understanding of research processes and engages them in enquiry-based projects so they are producers and not just consumers of knowledge.

Active learning

Engages, enthuses and challenges students in the learning process through activities, often collaborative and reflective, inside and outside the classroom; students construct knowledge and build independence.

Authentic assessment

Assesses students using tasks that mirror those they might undertake as professionals or citizens through choice of purpose, format, intended audience, resources, and collaborative or student-designed elements.



Confidence

Confident graduates are curious, creative, proactive and resilient; they are engaged with the world beyond the University and able to adapt and apply their knowledge in new contexts.

Digital fluency

Digitally fluent graduates think critically about the information they find, use and generate, developing their ability to use digital platforms to problem-solve, create, collaborate, and communicate.

Global citizenship

Global citizens are active members of their community from the local to the global, the personal to the professional, committing to principles of equality, fairness and sustainability.

06

Liverpool Hallmarks

Research-connected teaching

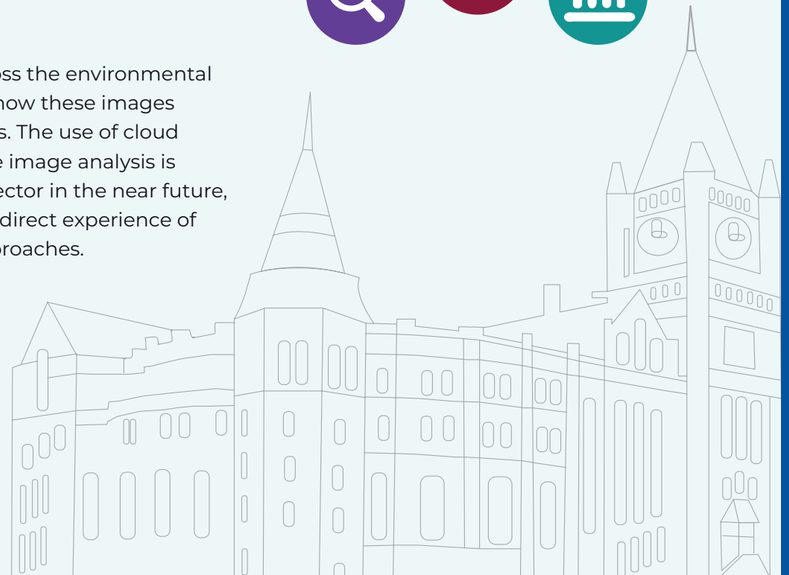
These tools are being actively used by the academic community for rapid satellite image analysis and produce research standard data (see Lea, 2018). Their accessible nature means that students are able to undertake research level analysis by removing traditional barriers to entry that normally make teaching this topic in universities highly problematic (e.g. limited internet bandwidths for downloading data; availability of educational licenses for specialist software; university firewall restrictions; limited student hard drive space). This enables students at all levels to directly engage with research level practices.

Active learning

The very nature of the tools encourages students to explore environmental changes occurring anywhere on the planet over the last 40 years. They are responsible for defining how imagery is visualised, the type of imagery they wish to visualise, and generating data from the imagery. As such, students are able to see the processes described in lectures for themselves in the real world, and take a lead in their identification.

Authentic assessment

Satellite imagery is used regularly across the environmental science sector, and understanding of how these images are processed provides invaluable skills. The use of cloud computing resources for rapid satellite image analysis is likely to increase dramatically in this sector in the near future, and these tools provide students with direct experience of what can be achieved using these approaches.



07

Graduate attributes

Confidence

The flexibility and ease of use of these tools allow students to undertake otherwise prohibitive levels of analysis in seconds. The tools allow them to explore satellite imagery and create data at rates that even established researchers would previously have been unable to achieve.

Digital fluency

The tools utilise cloud computing resources in a highly accessible way, even allowing students who lack any formal coding training engage directly with this technology. The code for the tool is also viewable, and commented allowing students to see how the tool has been constructed. Dissertation students at UG and PGT level are also encouraged to alter parameters in the code to allow data to be visualised in ways that are more fitting for their project.

Global citizenship

The tools allow satellite imagery for any point on the planet to be explored rapidly and with ease. Comments from both students and researchers who have used the tools suggest that they regularly use them to “procrastinate” by exploring particular locations around the globe that are interest to them to see how these environments have changed. This often includes topical events such as hurricanes, volcanic eruptions, earthquakes and wild fires. This improves students’ awareness of the world around them and the impacts that such events can have on the planet.

08

Other disciplines

The ease of use of the tools make them supremely accessible for users who lack any formal satellite image processing training. Consequently they are potentially transferable to users of any discipline who are interested in any aspects of visualising the earth's surface and/or the changes it has undergone, including urban cover, disaster relief, archaeology, vegetation change, water resource management, and many more. More generally, the transferable aspect of this case study is incorporating an innovative research tool into UG/PGT education which can enhance data analysis.

09

Advice

Many research level tools and methods of analysis exist that are otherwise inaccessible to UG/PGT students due to the level of methodology expertise required for their execution (e.g. coding and/or informed definition of key parameters).

The tools described in this case study do not necessarily perform any novel analysis, but rather package the analysis in a way that is accessible for students. This is achieved through the creation of a user interface and defining default values for key parameters that perform well in the majority of scenarios.

For other disciplines, this could be achieved through either similar user interfaces, or scripts where students are able to easily find and alter key variables to explore how these change the analysis.

Use of open-source/freely accessible software is also highly recommended to allow students to perform these analyses using their own computers.

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Contact

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