

12 - 3D image watermarking for protecting micro-CT data exchange

Posters, Exhibition and Necsia Visit - Monday 23 September 2013 15:10

Presenter: Dr. SUBSOL, Gérard (LIRMM-CNRS, France)

In the context of microfocus X-ray imaging of fossils that constitutes an important part of the heritage in a country, more and more digital 3D images are being sent over computer networks. Institutions curating fossil collections attribute legal and ethical weight to these data; acknowledging their own rights and thereby willing to ensure the protection of data in their possession. From a practical and technical point of view, it is often important to achieve : (1) the confidentiality of the data, by restricting access to the rightful owners ; (2) the integrity of the data, ensuring that the information has not been, and will not be, modified by anyone; (3) the availability, which guarantees access to the data within standard procedure to persons in agreed conditions.

An important issue is then to trace digital 3D images along the chain from their acquisition to their scientific investigation. Watermarking algorithms provide traceability by embedding a message directly into the 3D image in a quasi-invisible way. The very small difference between the original image and its watermarked version corresponds to the watermark signal associated with the embedded message. Of course, care must be taken to ensure that the watermarked 3D image has the same value as the original one.

Watermarking involves in general the insertion of a code identifying the owner but it is also possible to insert a trace linked to the user. Several cases making use of watermarking can be identified :

- the authenticity of images with the insertion of data confirming the origin and the fact that a certain 3D image refers to a particular fossil and institution ;
- controlling the integrity of 3D images, by putting control information, such as a digital signature, within data ;
- the addition of meta-data, allowing the content of images to be enriched by attaching a semantic description of the content.

Watermarking techniques are numerous and but they share some characteristics which, depending on the application, should be kept in mind when choosing the appropriate technique: robustness, capacity, complexity and invisibility.

We will present preliminary experiments on micro-CT images of anatomical structures and fossils.

14 - Digital X-ray Tomography as an alternative method for Invertebrate Taxonomy and dissecting valuable Invertebrate specimens.

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Presenter: Mr. DESCHODT, Christian (Rhodes University)

Macroderes Westwood (Scarabaeidae: Scarabaeinae) is a flightless dung beetle genus that is endemic to Namaqualand in the arid South-West of South-Africa. All species are strongly convex in shape and show uniform morphology. This makes it difficult to separate them even with the use of a conventional light microscope. Furthermore, some species are known only from single up to very few specimens.

3D Tomography as opposed to conventional 2D photography allows for the accurate placement of landmarks on homologous structures of different specimens. These 3D co-ordinates can be imported into morphometric and statistical software that makes between-species delineation possible. The main advantage of this technique is its non-invasive and non-destructive nature - that once a specimen is scanned it does not have to be touched again. Thus, there is no further risk to specimens that are often fragile, nor is there any necessity to conduct dissections to view obscured or internal structures.

Here we present preliminary results in a novel and alternative application in zoology to distinguish between the species in the dung beetle genus *Macroderes*.