

Visualising evolution in 4D using X-ray CT

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Abstract:

X-ray computed tomography, or CT, has become a primary tool for imaging biological specimens in 3D, be it fresh tissue, ethanol-preserved organisms, or mineralised fossils. The power of CT to visualise internal features without disarticulation makes it particularly valuable for the study of museum collections, which house millions of physical specimens documenting the spatio-temporal patterns of life. Here I present examples from my career of CT-based research in natural history museums, using a growing toolkit of methods to quantify phenotypic variation over time and space. So far these studies have included limited numbers of museum specimens, due to the challenges of capturing high resolution CT data for large sample sizes. However together with the 3D Imaging Center at DTU, we are developing methods for the high throughput CT scanning of entire museum collections using standardised packaging, a robotic arm, and material-specific (e.g., wet vs dry) parameters. This effort will fill existing gaps in community-level CT sampling, which could provide new insights into evolutionary responses to environmental change. These actions will also be accompanied by automated pipelines for anatomical phenotyping, providing a wealth of information for understanding the past, present and future of biodiversity at the organismal and ecosystem levels.