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GEODESY 4.0: GEODESY TRANSFORMATION VIA NEW TECHNOLOGIES

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Introduction

Geodesy studies the Earth's shape, dimensions, and positioning of objects on its surface. In the digital age, it is evolving into Geodesy 4.0, characterized by the use of advanced digital technologies. These innovations—outlined below—enable faster, more accurate, and automated geodetic processes across various fields.

Geodesy 4.0 – Key Technologies and Applications

Geodesy 4.0 marks the digital evolution of the field through intelligent technologies.

Fig. 1. Stages in the digital transformation of geodesy

- **Drones & Photogrammetry:** Capture aerial imagery to create 3D models and digital maps.

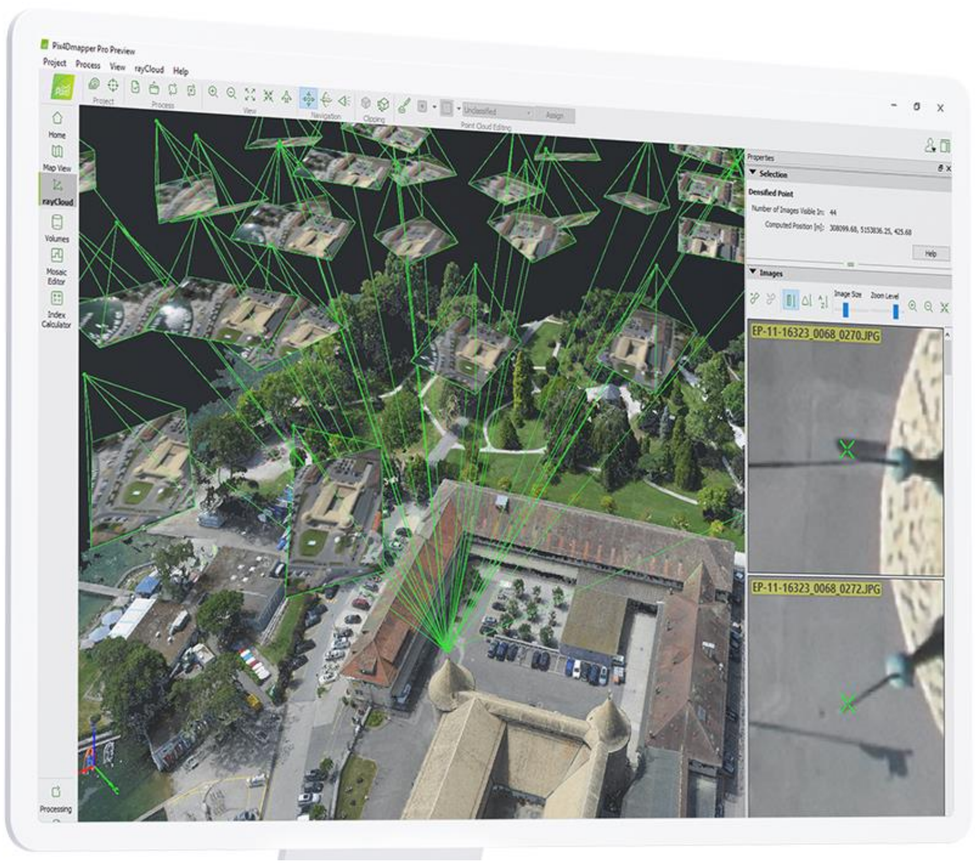

Fig. 2. 3D model generated using Pix4D software

- **GNSS:** Provides precise location data for surveying and mapping.
- **LiDAR:** Scans terrain to create detailed 3D models.

Fig. 3. NASA's LiDAR system flying over Greenland to test space-based elevation measurement.

- **AI & Machine Learning:** Analyze spatial data and detect patterns.

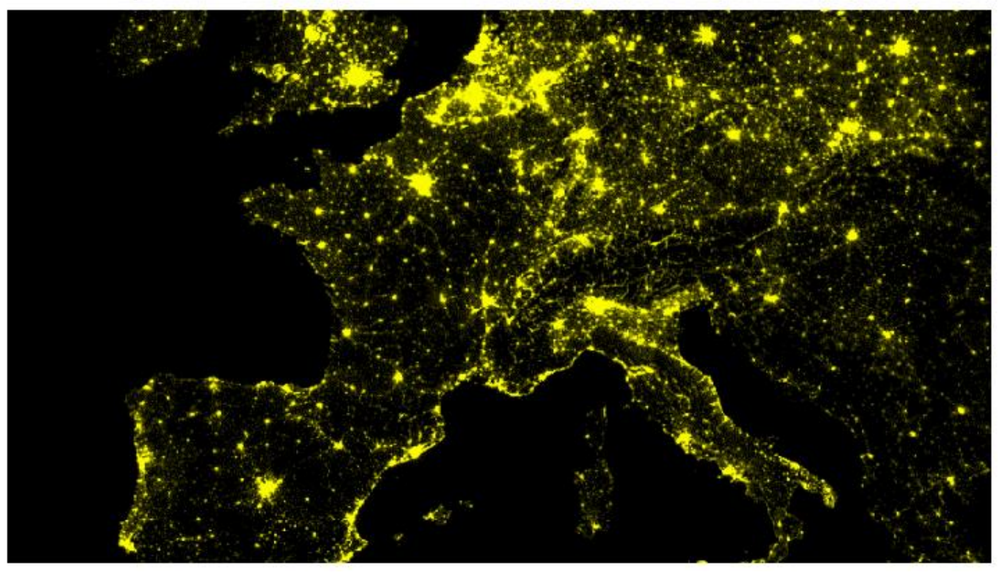

Fig. 4. Satellite data in Google Earth Engine, including night-time imagery from DMSP-OLS.

- **IoT & Sensors:** Enable real-time monitoring of structural and environmental parameters.
- **VR / AR, Cloud & Mobile Tools:** Support remote access, visualization, and field collaboration.

Challenges and Perspectives

Modern geodesy faces issues such as data accuracy, equipment maintenance, and regulatory concerns. Sustainability and ethical data use are essential. Integrating automation, GIS/BIM, and smart tools enhances efficiency. Continuous training helps professionals stay updated with new technologies.

Conclusion

Geodesy 4.0 optimizes geodetic practices, offering new opportunities for sustainable development and environmental monitoring.