Future outlook

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TERRA
Remote rock mass characterization

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Science fiction or reality?

Source: Prometheus movie (2012)

Digitization

Mobile rock mass mappers

https://www.rockmasstech.com/rockmass-eon

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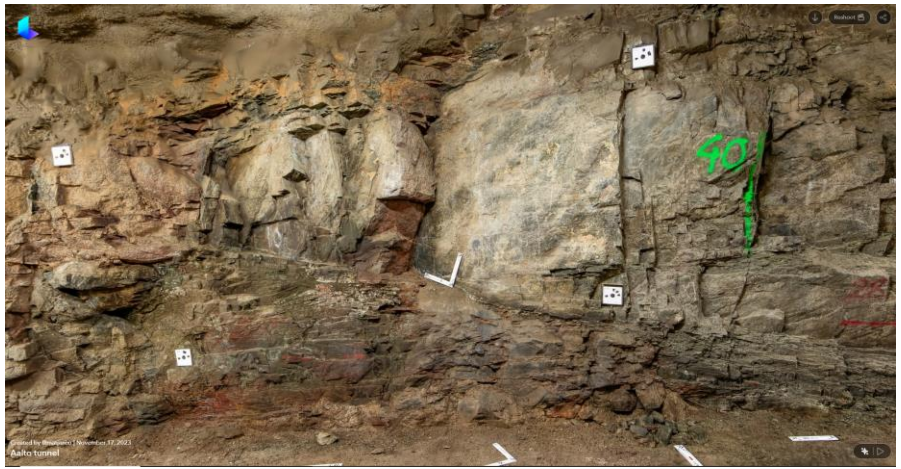
New methods: NeRFs, Gaussian Splatting

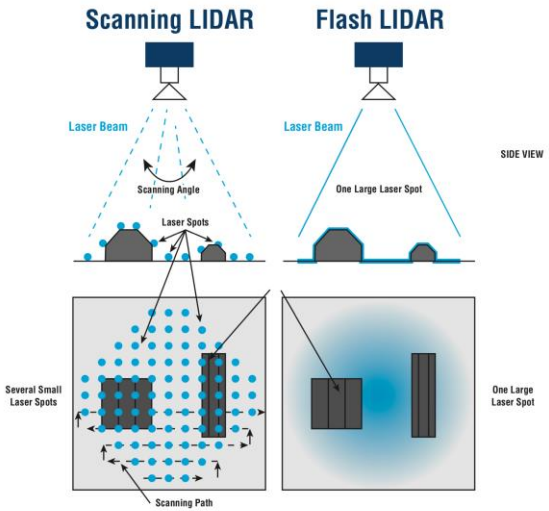
Polycam

Luma AI



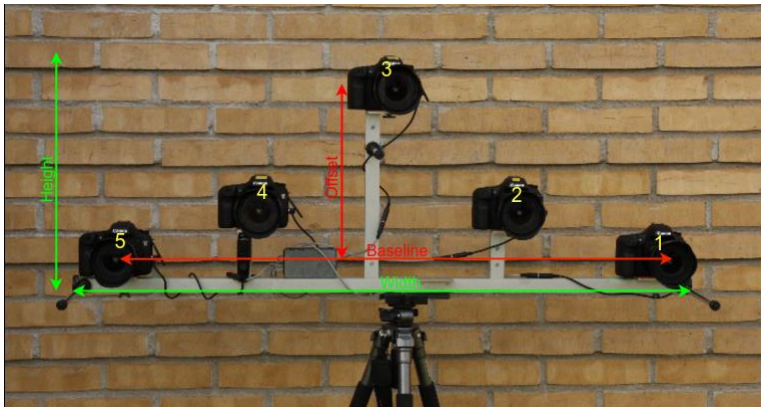
Rapid mobile scanning

FARO Orbis



asc3d.com

Multi-camera systems



https://www.mosaic51.com/cameras/mosaic-x/?playlist=72dd746&video=1cf8024

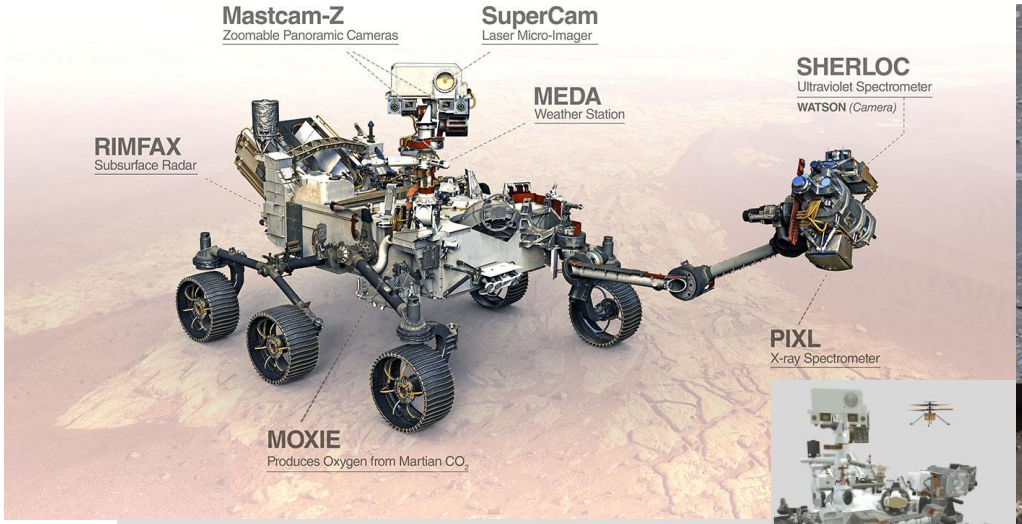
Fully autonomous data collection

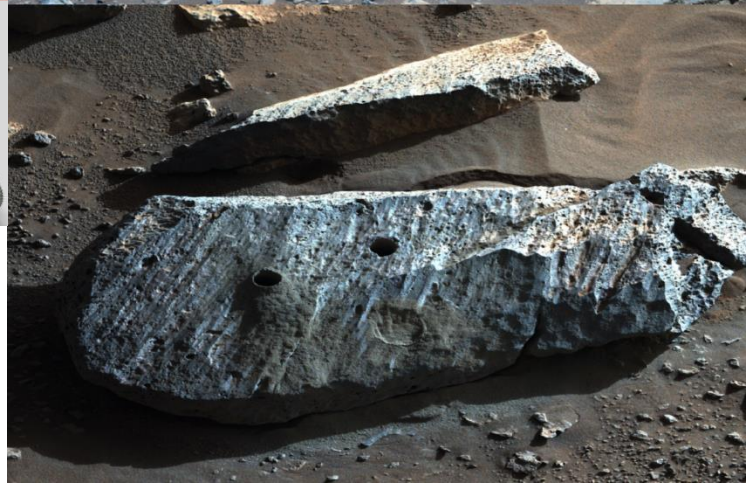
Youtube video: Boston dynamics robot dog

https://enterprise.dji.com/dock

Fully autonomous mines

Remote mapping of other planets





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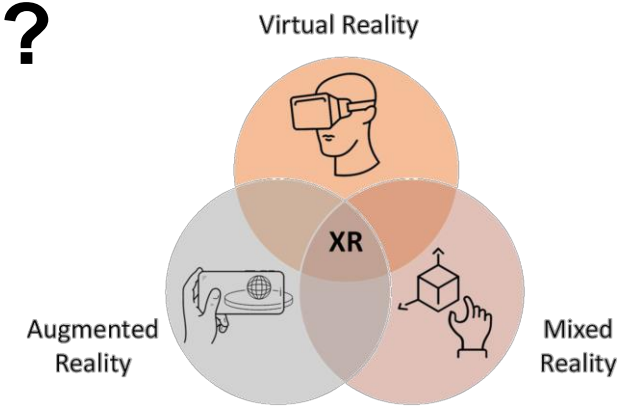
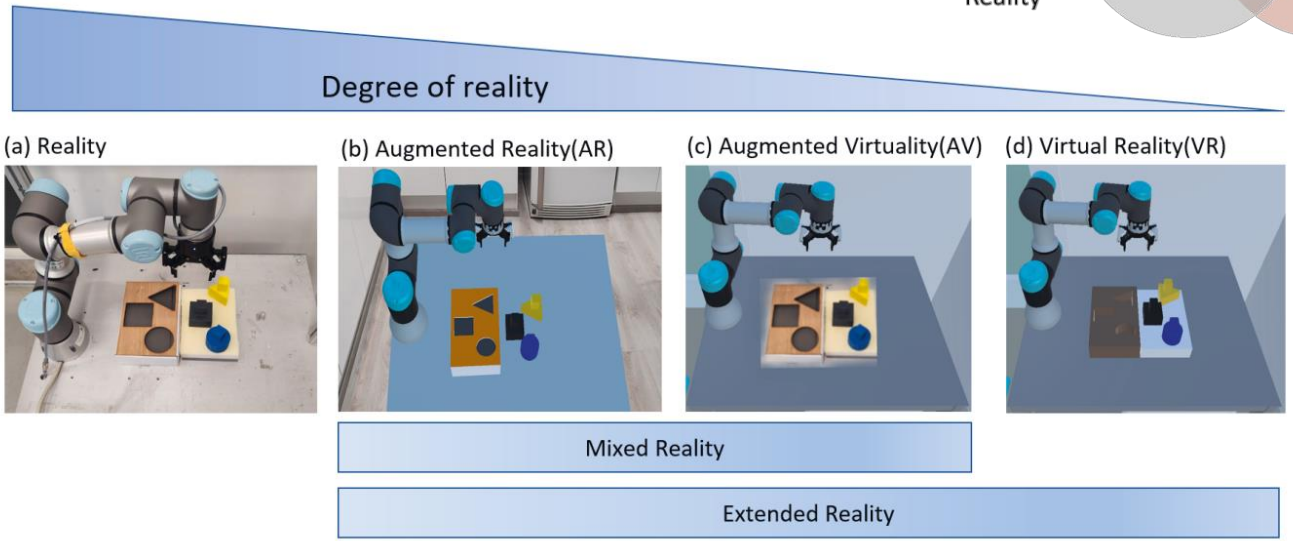
https://sketchfab.com/Mastcam-Z

Immersive data visualization

What is eXtended Reality XR?

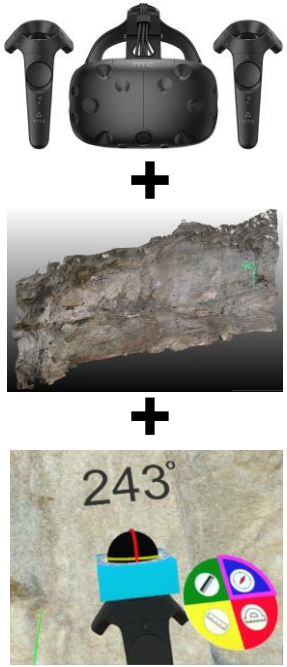


Reality-virtuality continuum



Kaarlela (2023)

VR systems for remote mapping



https://youtu.be/8Zxtotw_vyg

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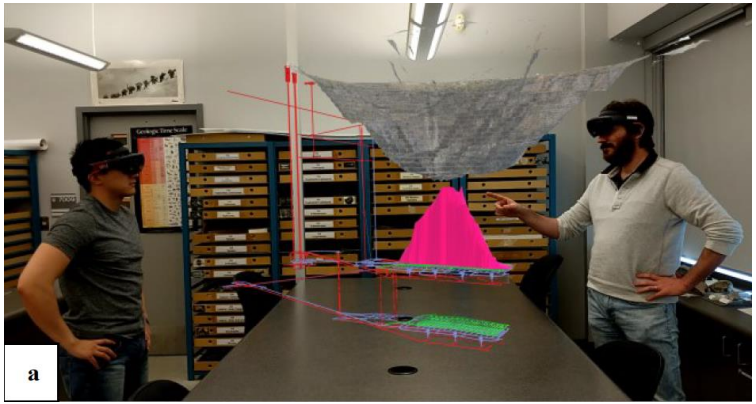
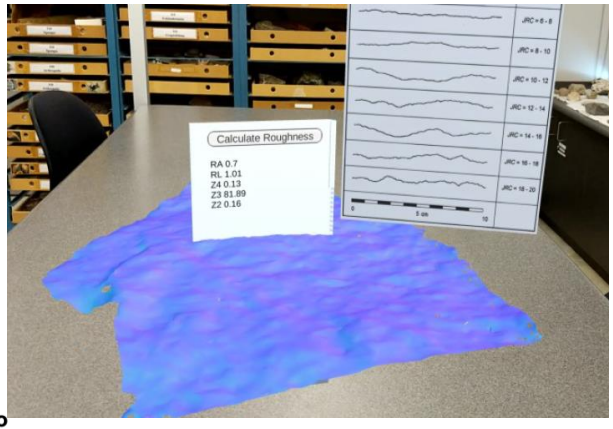
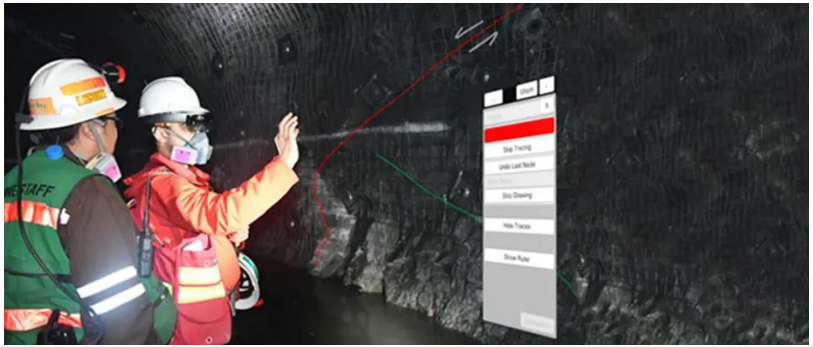
MR rock mass characterization

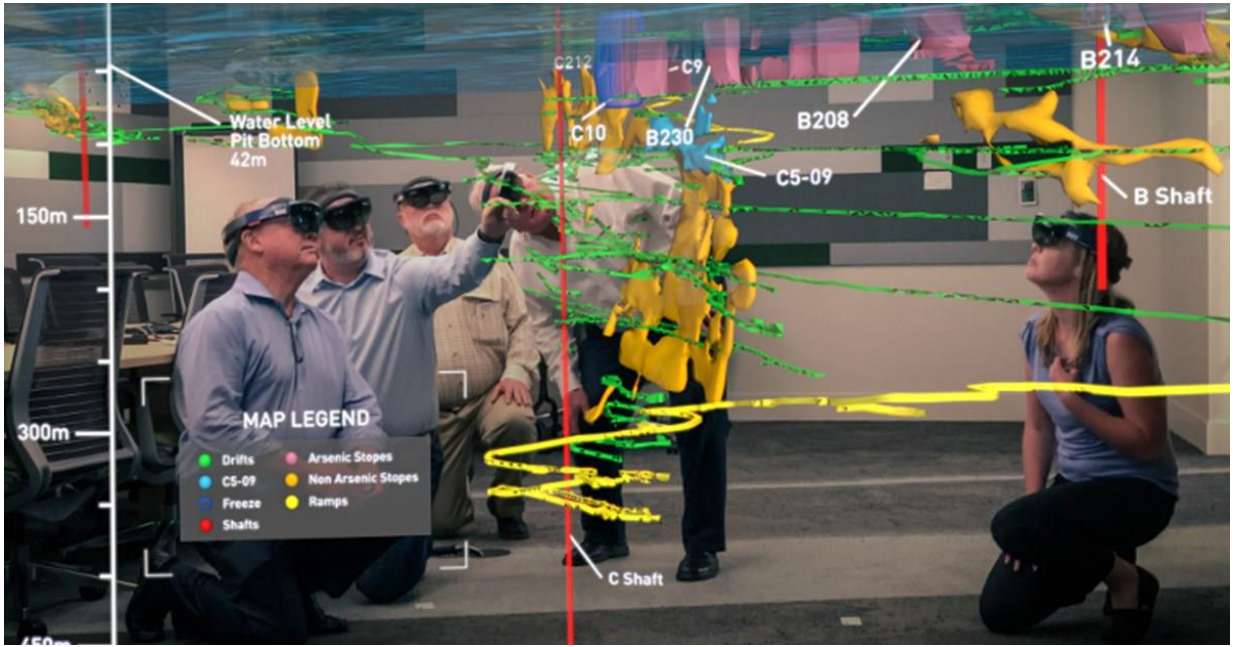






Onsel et al. 2019. Applications of mixed and virtual reality techniques in site characterization

Remote data visualization and collaboration



Future outlook summary

- Not a science fiction anymore!
- Autonomous drone missions
  - combined laser scanning and photogrammetry
- Real-time remote inspection and communication via XR
- Fully automatic fracture mapping using AI
- Automatic implementation of fracture data into rock mass numerical models