Vejbelysningsdagen 2022
af Lasse Hedegaard Hansen

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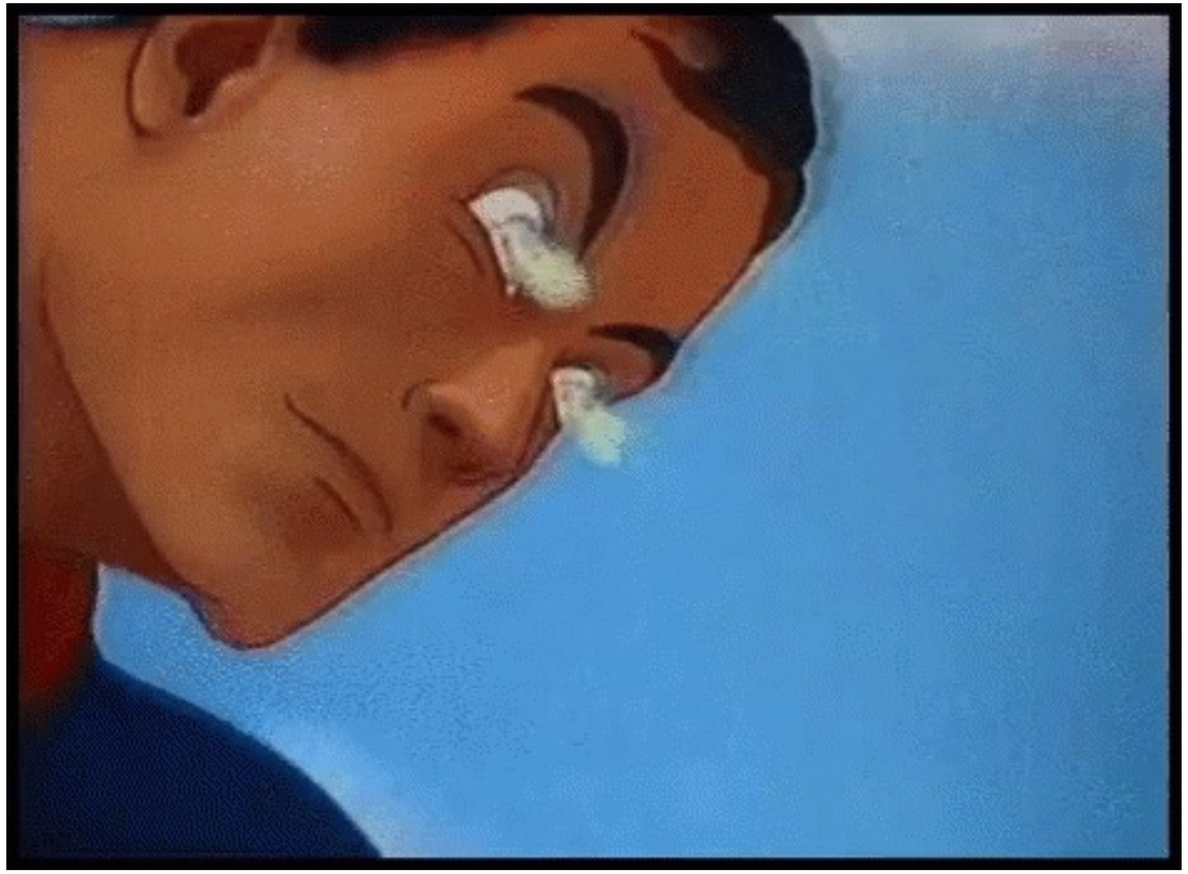
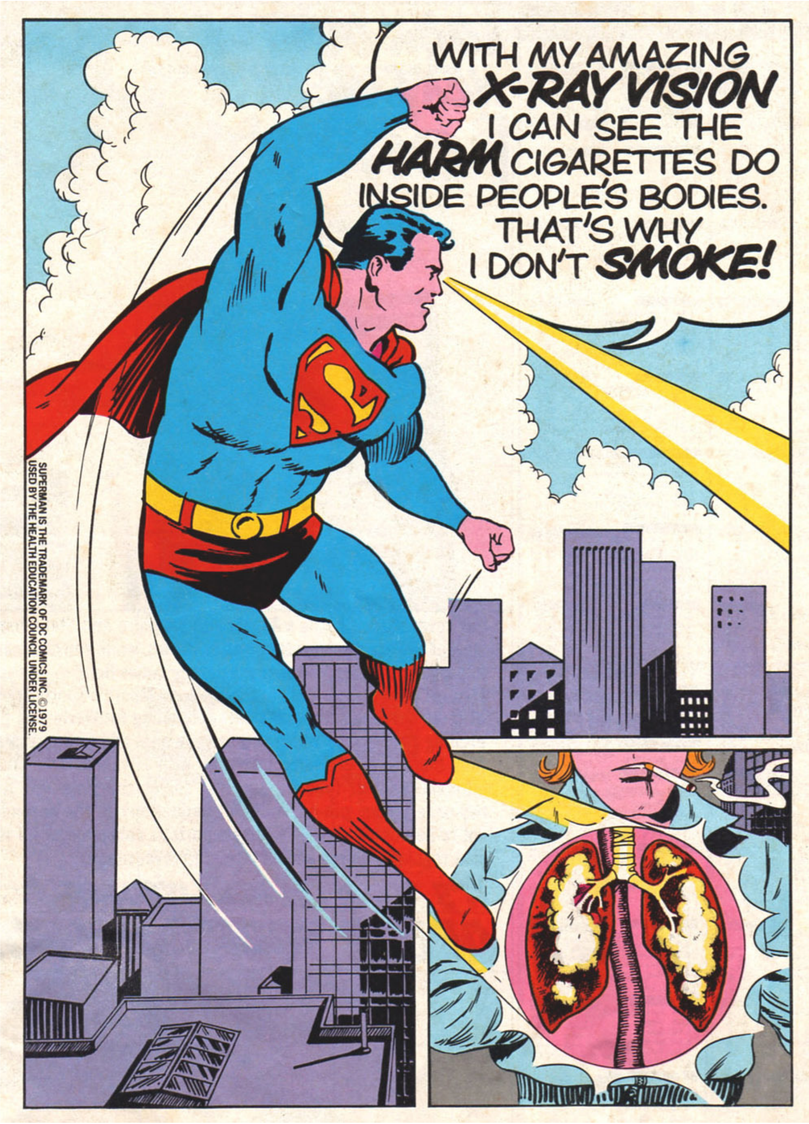
Visualisering af ledningsdata i marken med Augmented Reality

Augmented Reality er superpowers i marken





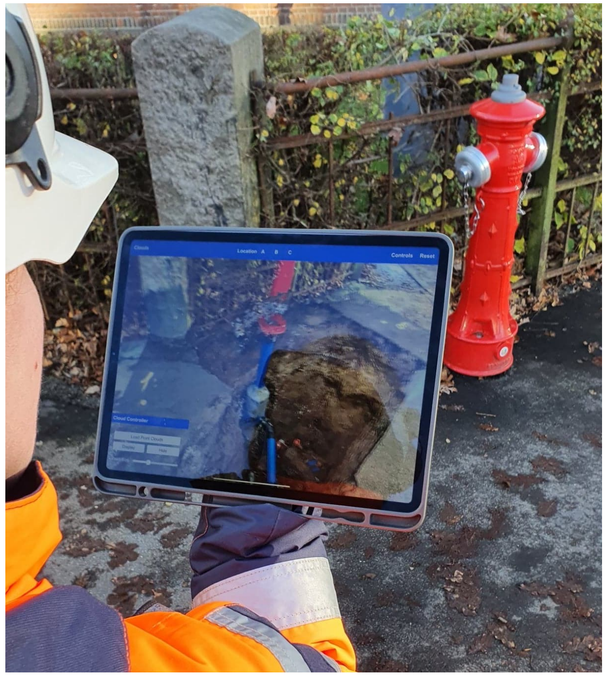
Eksisterende metoder til AR visualisering af ledninger

vGIS

Trimble SiteVision

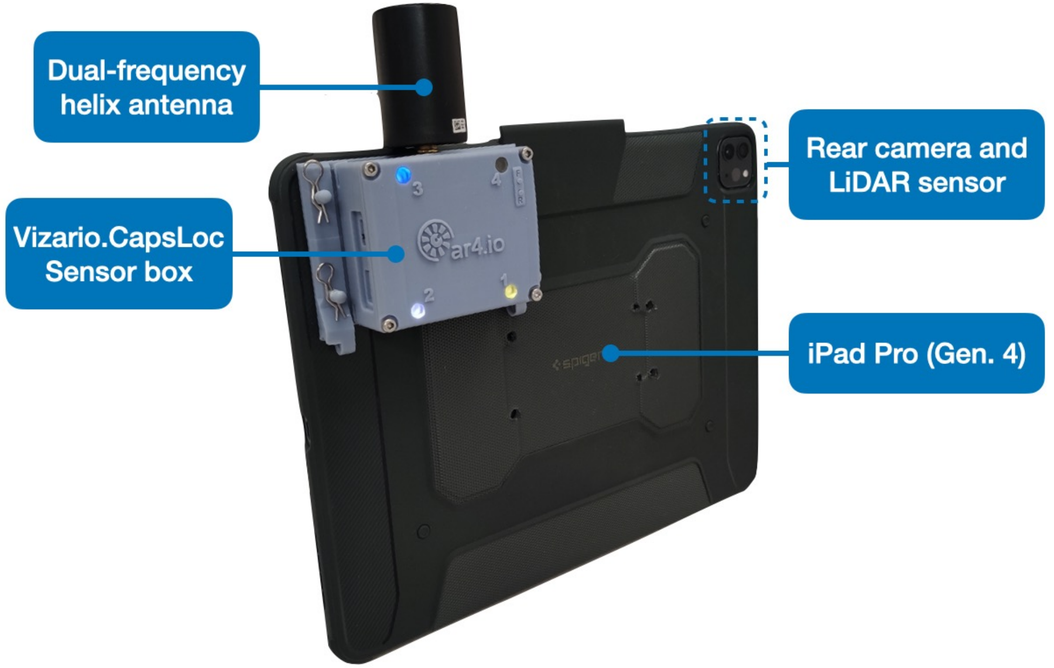
Augmented Reality for Subsurface Utility Engineering

Virtual Utility Daylighting



Virtual Utility Marking

Outdoor localisation



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TU Graz
Graz University of Technology

Vizario CapsLoc
made by: ar4.io

ISMAR 2021 video: https://www.youtube.com/watch?v=fRpniWVhMZA

Hansen, L. H., Fleck, P., Stranner, M., Schmalstieg, D., & Arth, C. (2021). Augmented reality for subsurface utility engineering, revisited. *IEEE Transactions on Visualization and Computer Graphics*, *27*(11), 4119-4128. doi: 10.1109/TVCG.2021.3106479

3D ledningsdokumentation giver nye muligheder

Novafos

aarhusvand

LE34

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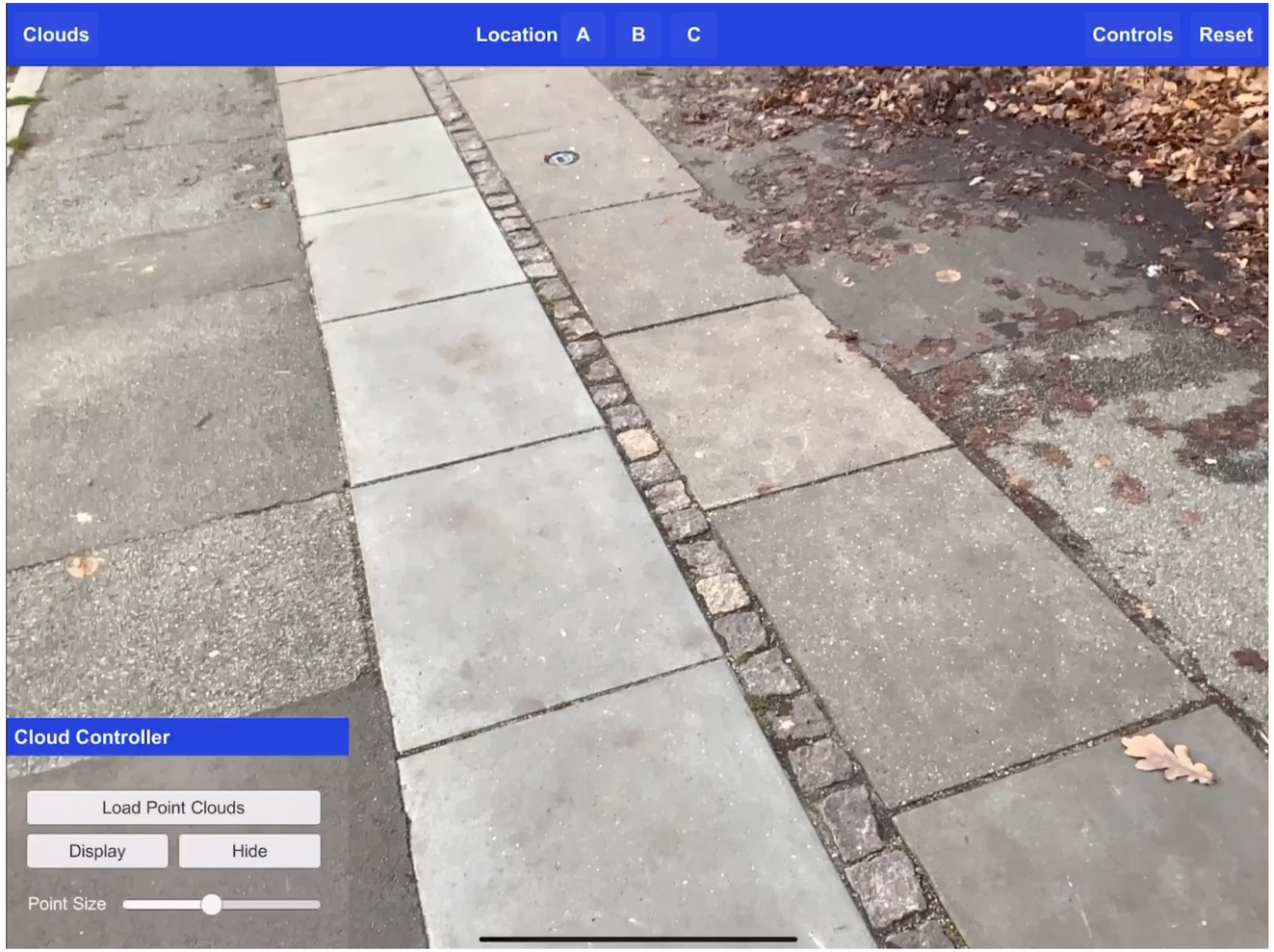
SmartSurvey©
Developed by IT34

Visualisering af 3D-punktskyer i marken



Integration med Trimble SiteVision

Trimble SiteVision

Trimble DA2 antenna

Evaluering af AR løsningen

- **Fordele**
  - Giver et virkeligt billede af hvad der er under jorden
  - Mulighed for at se placering, dybde, udbredelse og materiale mm.

”… det vil være rigtig fedt det her, det vil være en kanon hjælp, fordi med traditionelle ledningsoplysninger ser man ikke alle de kabelkrydsninger, som vi ser nu [med AR prototypen]…”

AARSLEFF®

- **Udfordringer**
  - LER data er lovpligtigt og vil derfor dominere som ledningsdata i marken
  - Deling af 3D punktskyer på tværs af aktører

Hvordan laver jeg en god visualiseringsteknik for traditionel ledningsdata?

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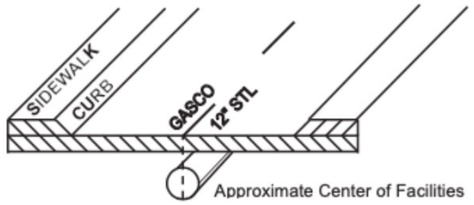
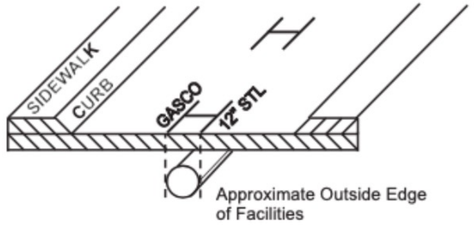
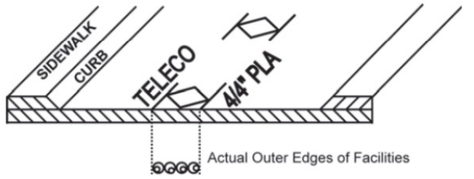
Single Facility Marking



Large Single Facility Marking



Conduit Marking



Uniform Colour Code

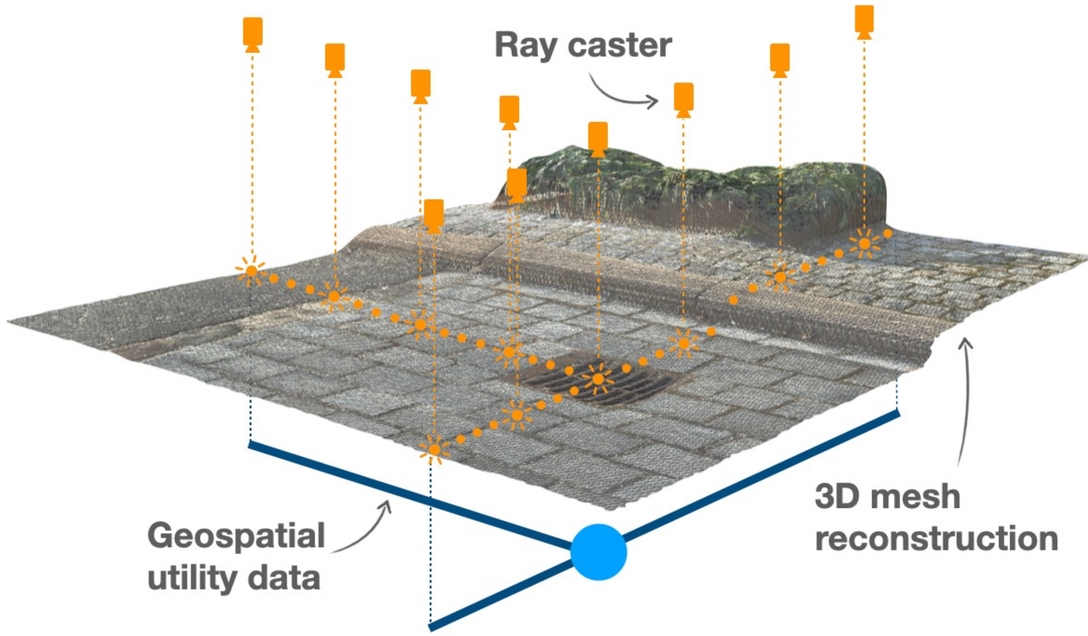
White	.....Proposed Excavation
Pink	.....Temporary Survey Markings
Red	.....Electric Power Lines, Cables, Conduit and Lighting Cables
Yellow	.....Gas, Oil, Steam, Petroleum or Gaseous Materials
Orange	.....Communication, Alarm or Signal Lines, Cables or Conduit
Blue	.....Potable Water
Purple	.....Reclaimed Water, Irrigation and Slurry Lines
Green	.....Sewers and Drain Lines

Common Abbreviations

CH	Chemical
E	Electric
FO	Fiber Optic
G	Gas
LPG	Liquefied Petroleum Gas
PP	Petroleum Products
RR	Railroad Signal
S	Sewer
SD	Storm Drain
SS	Storm Sewer
SL	Street Lighting
STM	Steam
SP	Slurry System
TEL	Telephone
TS	Traffic Signal
TV	Television
W	Water
W	Reclaimed Water "Purple"

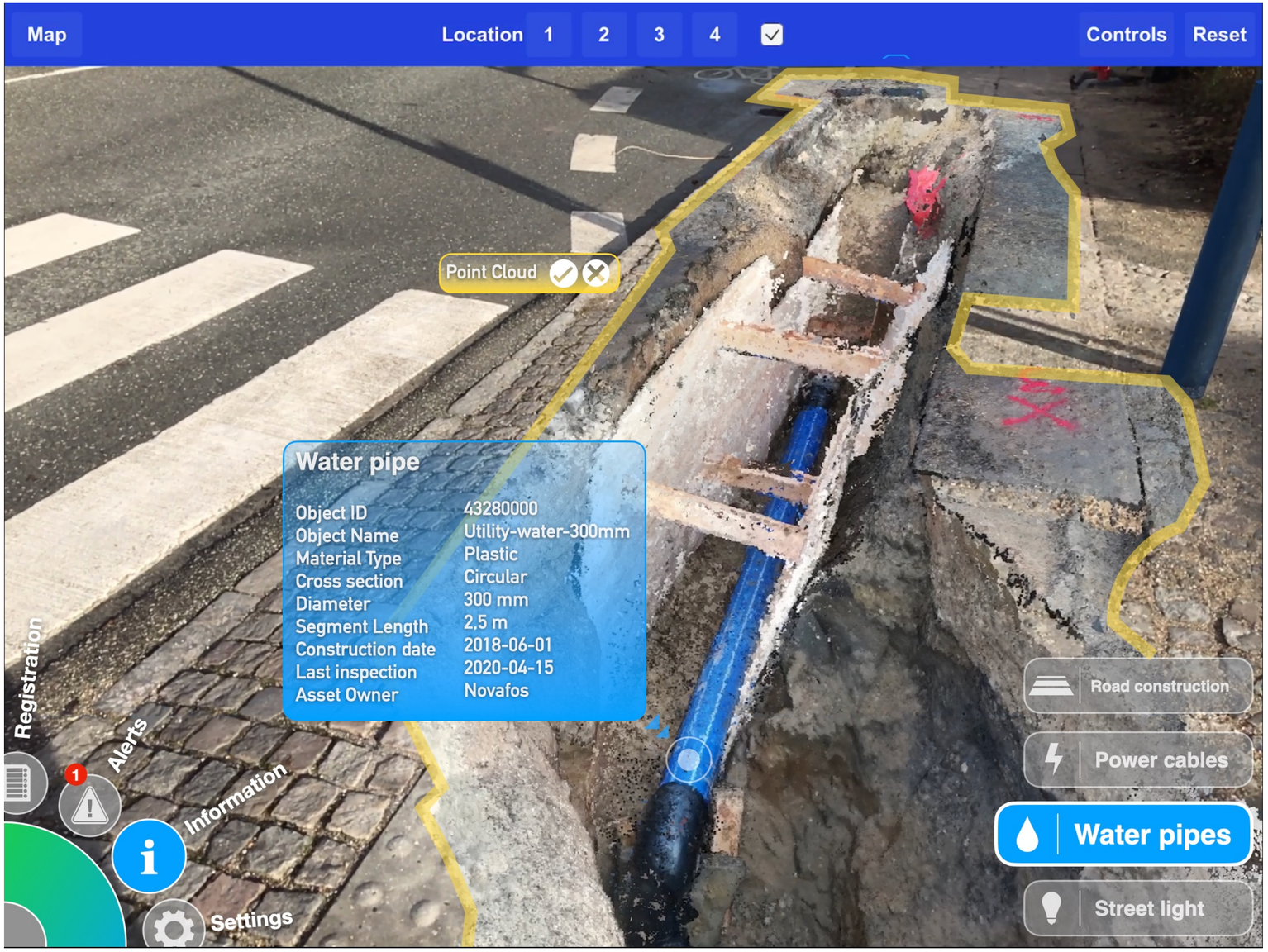
Marking Dimensions

LiDAR sensor i mobiltelefoner

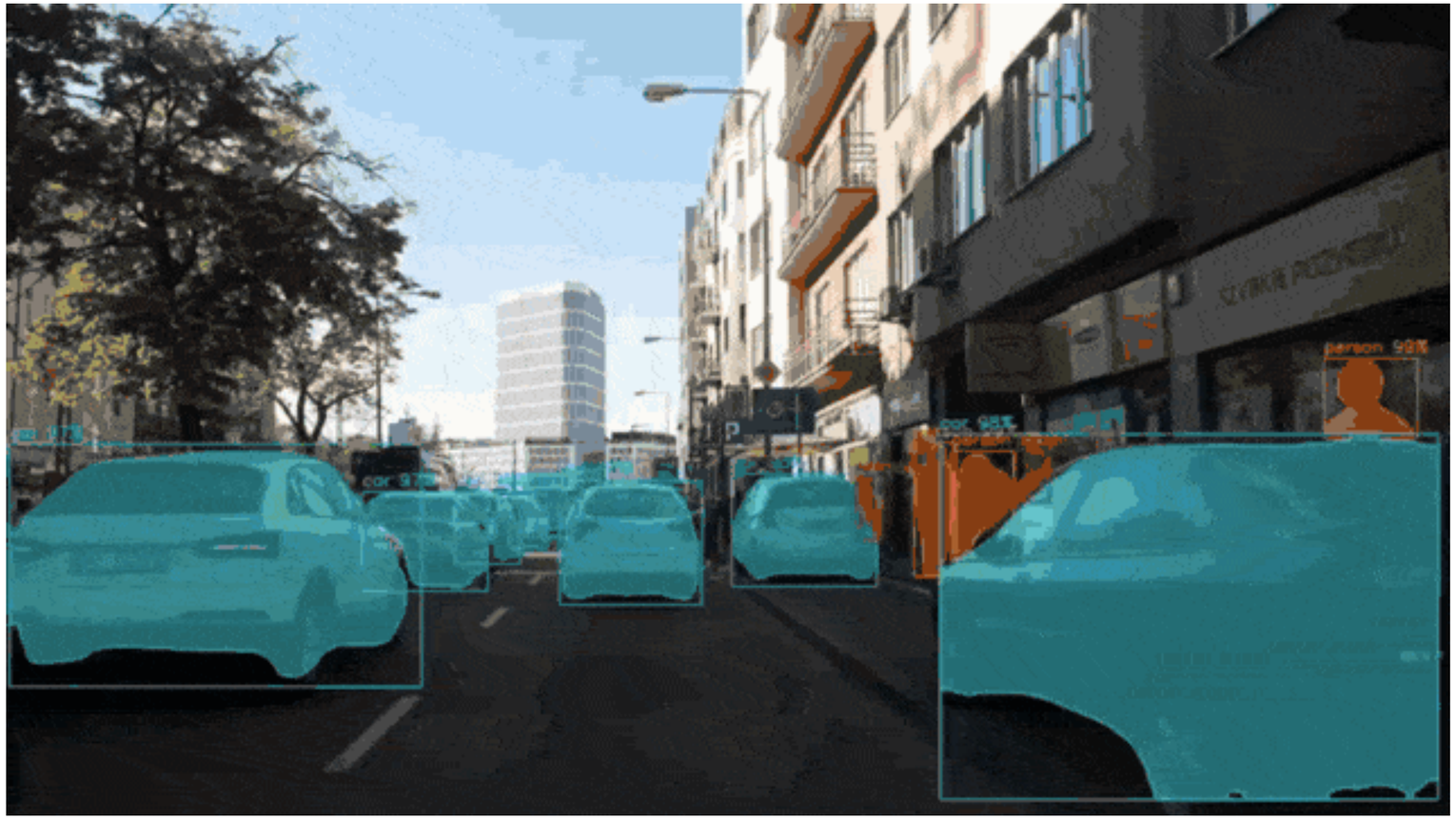


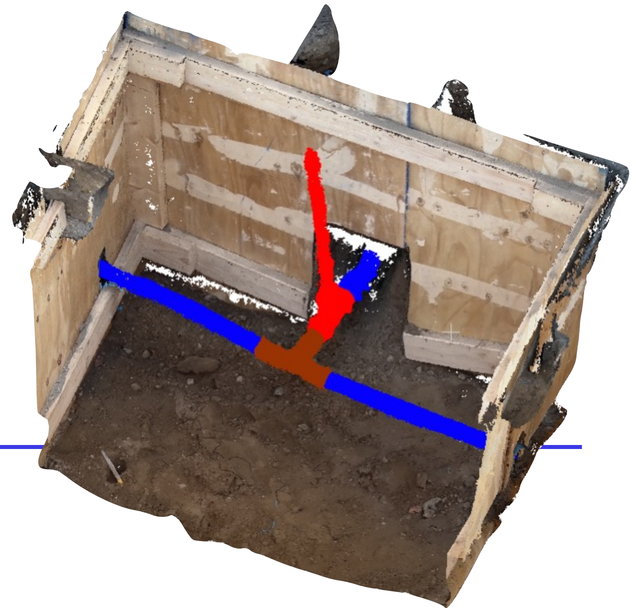
Næste skridt

- God visualisering men stadigvæk dårlig ledningsdatakvalitet…
- Link mellem 3D-punktsky og tradtionelle ledningsdata (attributdata)



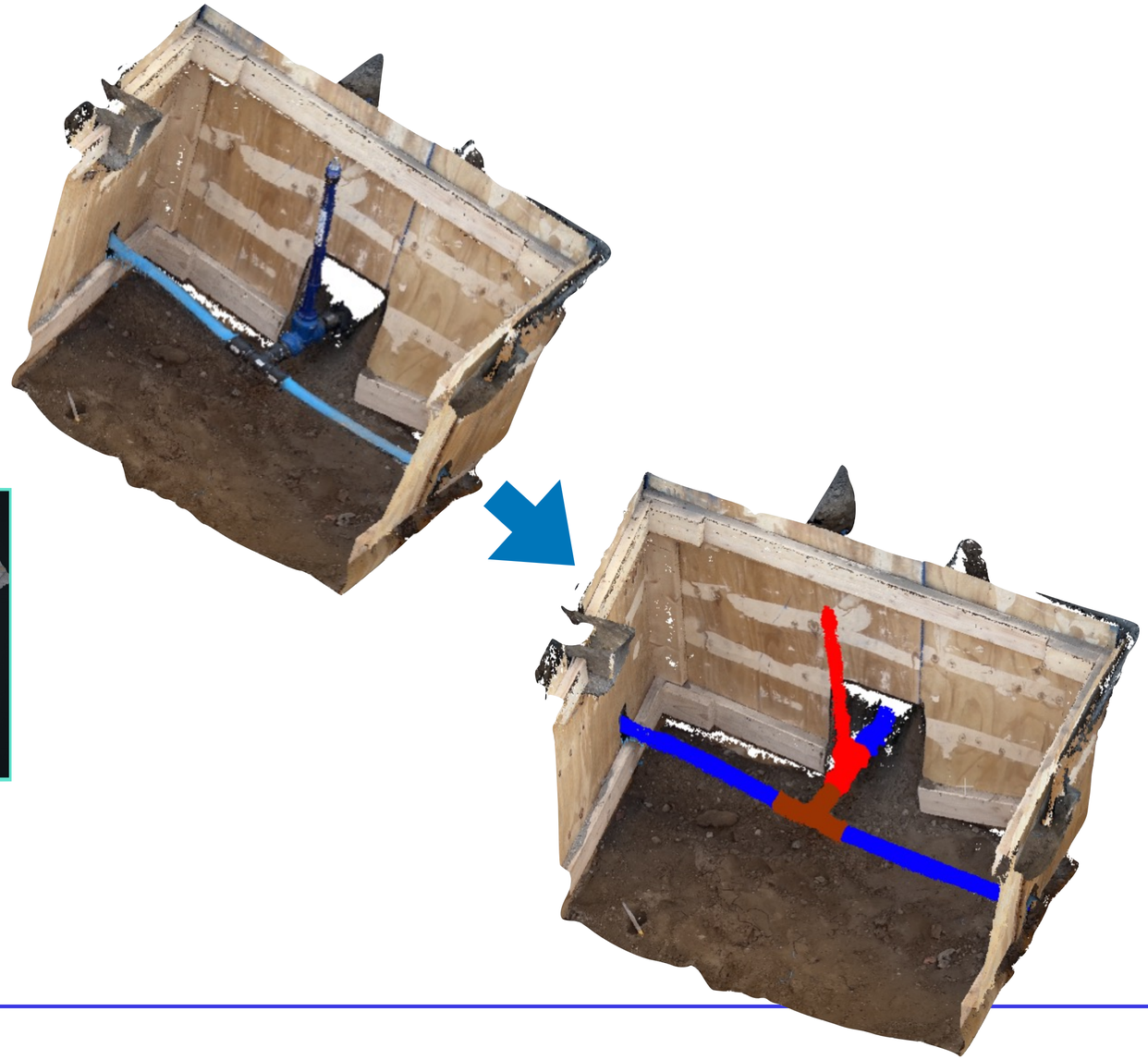
Deep Learning “AI” til at genkende ledningsobjekter



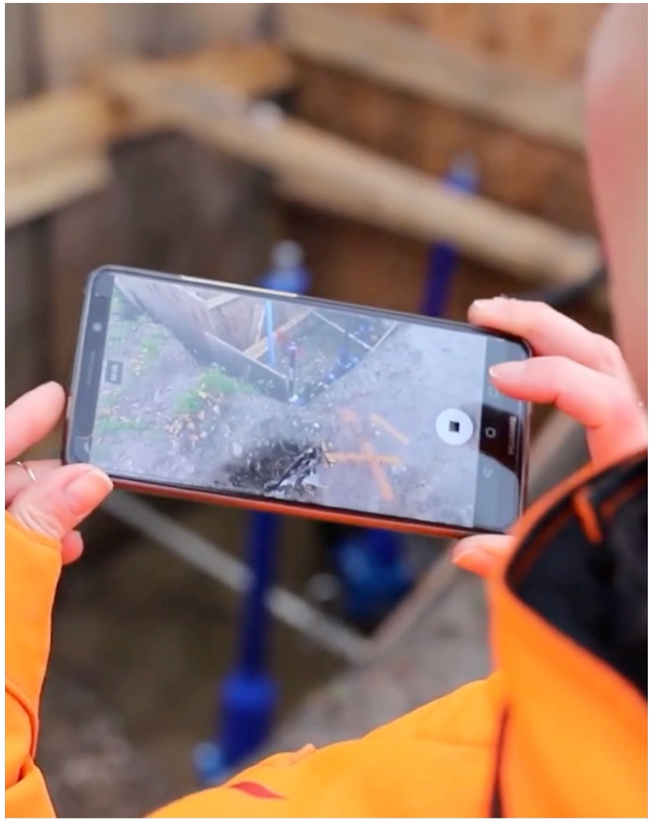


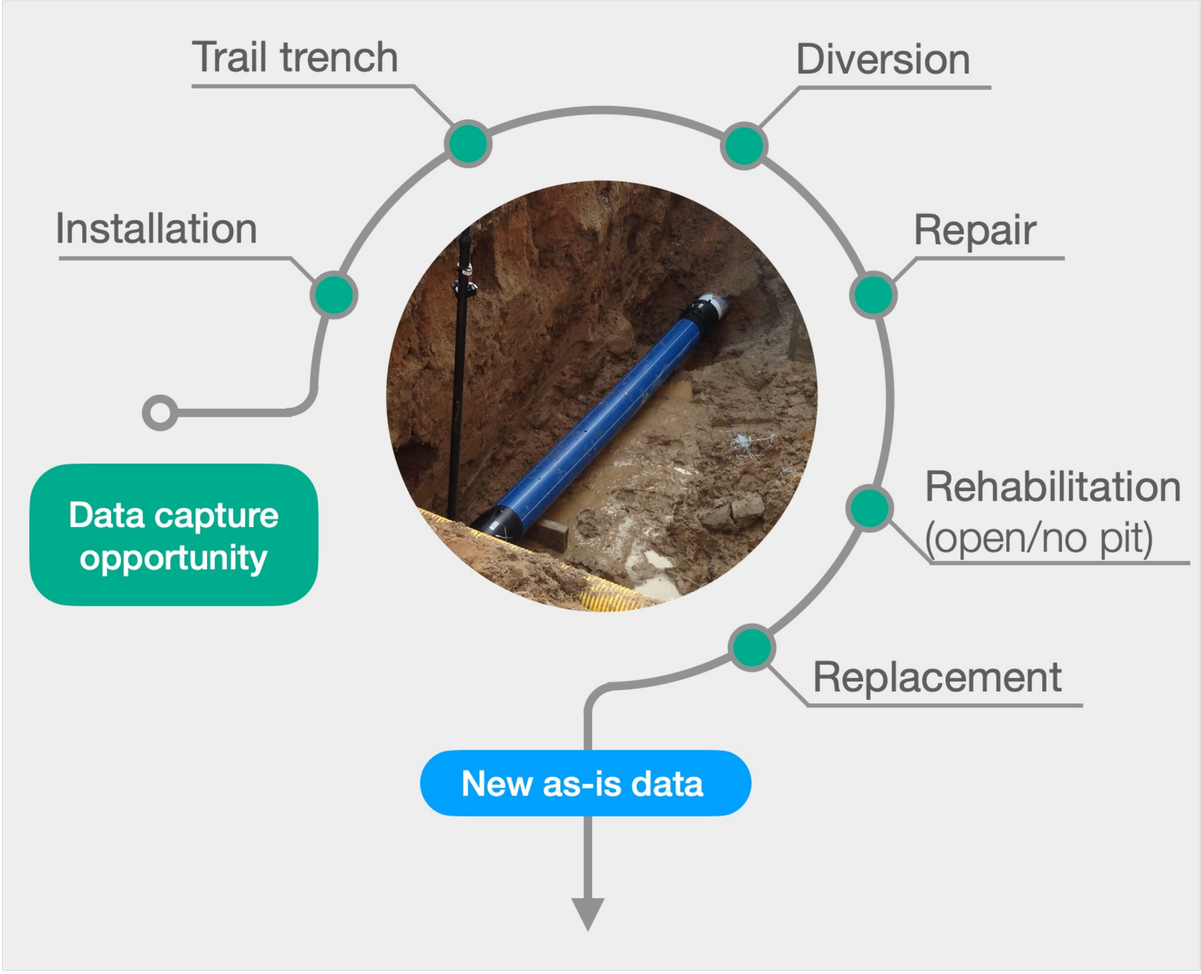
Deep Learning “AI” til at genkende ledningsobjekter

- Novafos har +6000 3D-punktskyer af ledningsgrave
  - Et unikt 3D datasæt på verdensplan!



Hvordan kan vi forbedre datakvaliteten for gamle ledningsdata?





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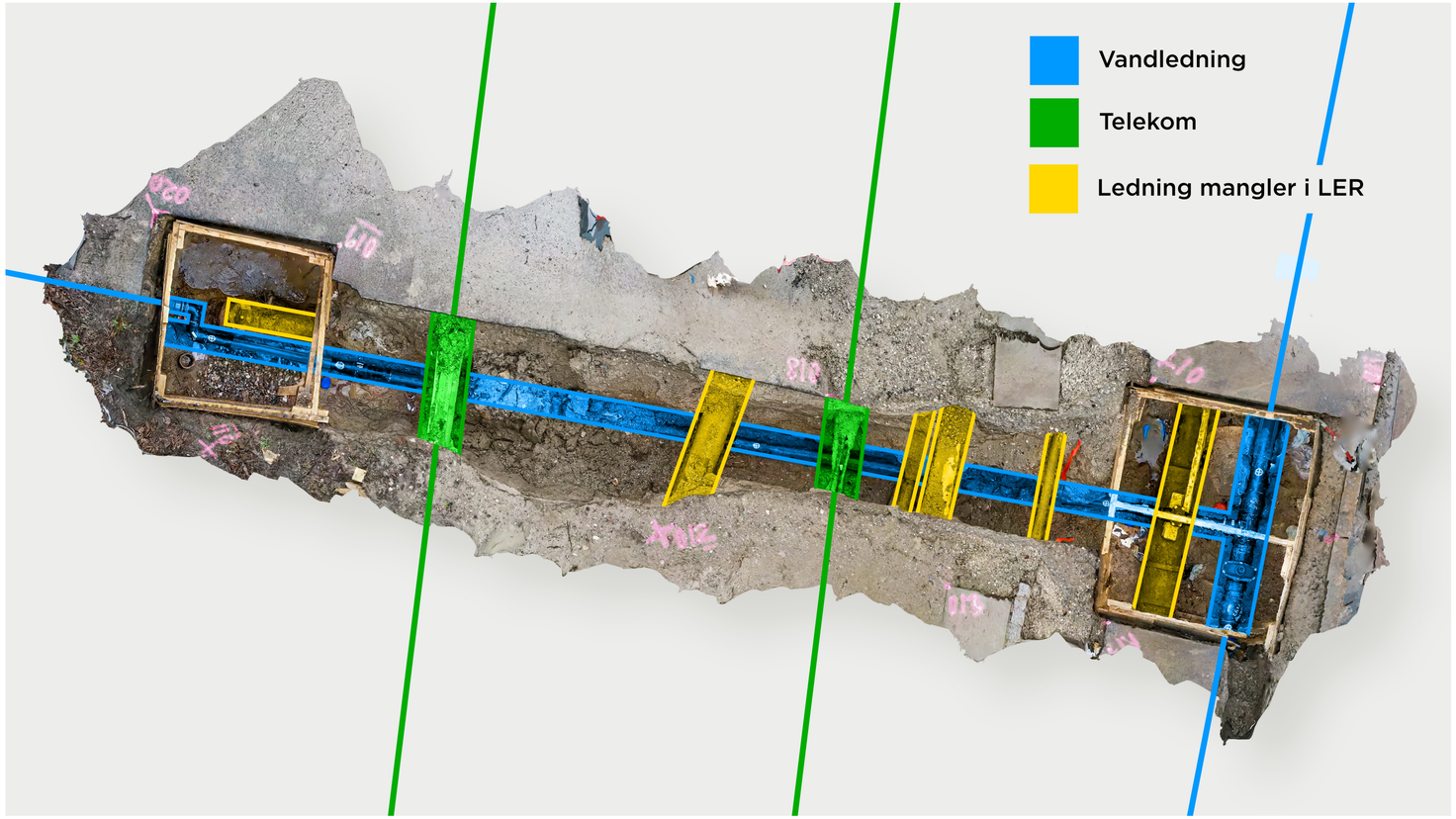

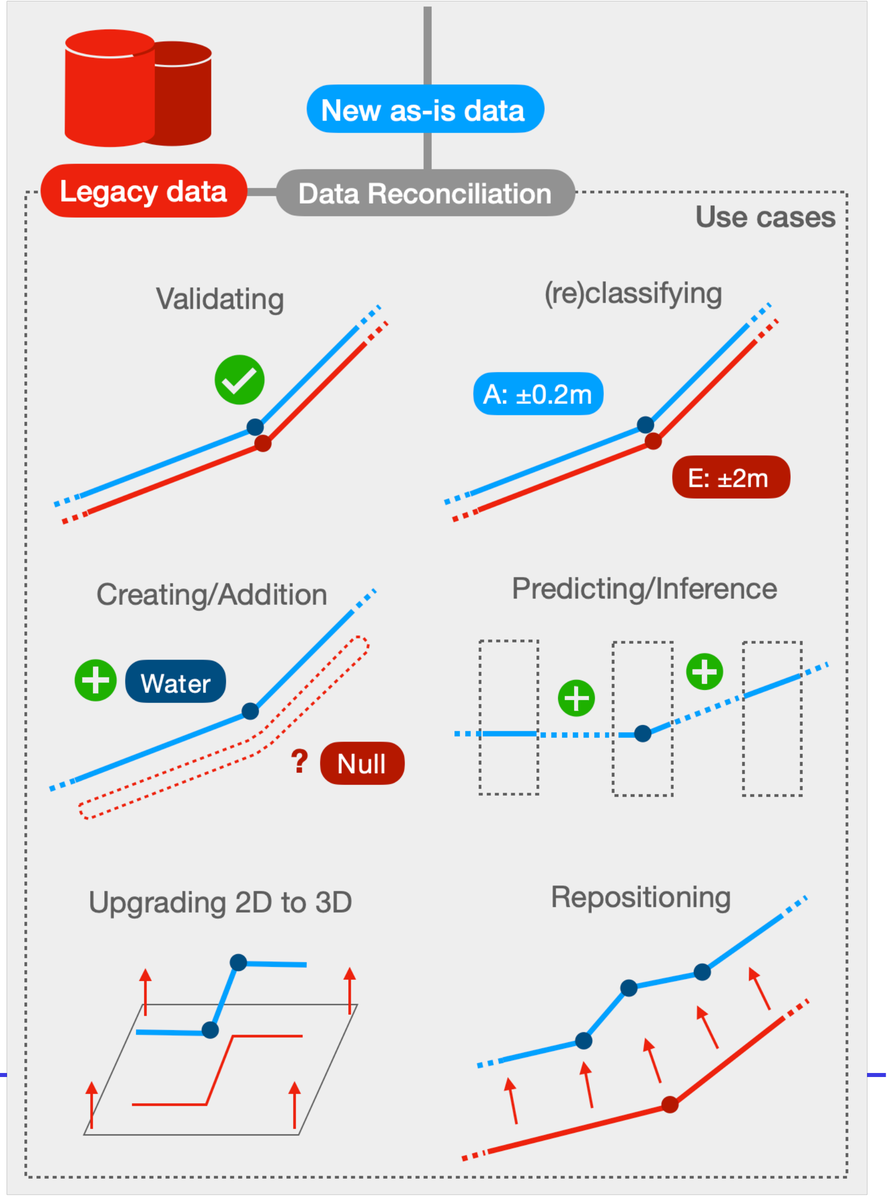

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