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Technology and Virtual Reality (VR) in Teaching

Working with virtual reality

Peter Surovy



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Program

Date	Activities
6.12.2022	8.30 Introduction and icebreaking 9.00 R-package for remote sensing 12.00 Lunch (provided by organizer) 13.00-16.00 R-package for remote sensing (continued)
7.12.2022	9.00 Data collection of terrestrial laser scanning and photos for 3d construction 12.00 Lunch (provided by organizer) 13.00-16.00 Data analysis for point cloud and 3d object
8.12.2022	9.00 Building of VR media from point cloud data 12.00 Lunch (self-paid) 13.00-16.00 Building of VR media from point cloud data (continued)
9.12.2022	9.00 Modeling Forest growth with Sibyla software 12.00 Lunch (self-paid) 13.00-16.00 Modeling Forest growth with Sibyla software (continued)



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Presentation outline:

- What is VR (what is AR)
- Introduction to Unity
- Introduction to Unreal
- Point clouds in VR
- Case study Czech forest



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Virtual reality (VR) is a simulated experience that employs pose tracking and 3D near-eye displays to give the user an immersive feel of a virtual world. (Wikipedia)



Augmented reality (AR) is an interactive experience that combines the real world and computer-generated content.



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Pokemon GO is one of the most famous apps

It makes interaction with the real world via GPS





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So what we can do in terms of technology:

- Smartphones and measurements of trees
- iOS Lidar equipment and capabilities
- Software and support
- iScanForest show case



What kind of sensors are available in smartdevices and what can we measure in tree world?

Camera:

- Diameter +-
- Height +-
- Basal area
- Machine learning for species, diseases etc..
- Photogrammetry for 3D

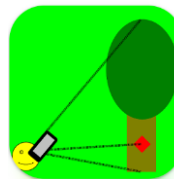


GPS:

- Positions
- Tracks/lines
- Polygons
- Maps

Accelerometer and gyroscope

- Distance!
- Horizontal positions
- Height
- Diameter



As of March 2020 : Lidar !

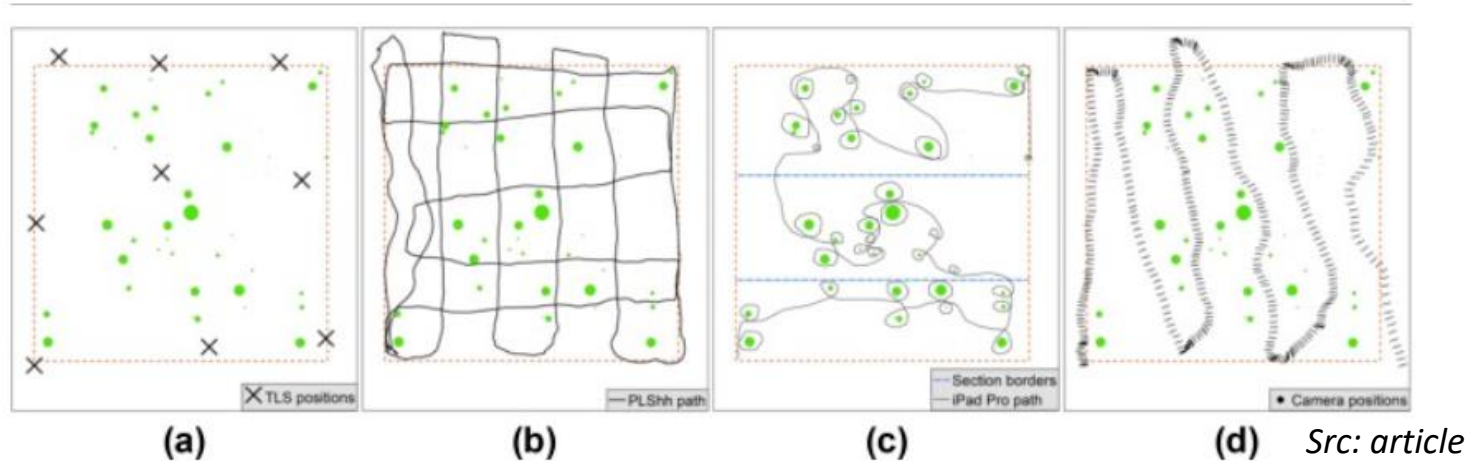


Proximity sensors, light sensors



Novel low-cost mobile mapping systems for forest inventories as terrestrial laser scanning alternatives

Martin Mokroš, Tomáš Mikita, Arunima Singh, Julián Tomašík, Juliána Chudá, Piotr Wężyk, Karel Kuželka, Peter Surový, Martin Klimánek, Karolina Zięba-Kulawik, Rogerio Bobrowski, Xinlian Liang



The iOS lidar is based on IR light and composed of 24x24 grid resulting in 576 points, with maximum scanning distance of 5 meters.



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The most important thing behind all though, is the software

Apple ARKit what does it do and what it can measure?

There is never only LiDAR data, more the artificial intelligence in the ARKit SDK combines photogrammetry and LiDAR data for reconstruction of the surroundings

Very rarely there is need for raw point cloud, more the mesh is used and analyzed

We must expect development in hardware but also in software

ARKit main forest/eco features:

- stored experience
- shared experience
- object recognition



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<https://iscanforest.fld.czu.cz/>



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iScanForest

Time To Explore

Smart Measurement With

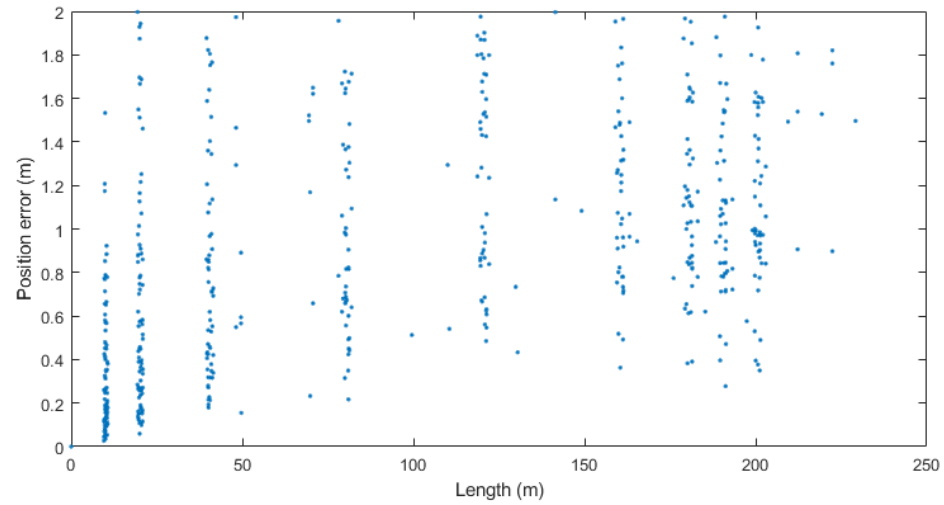




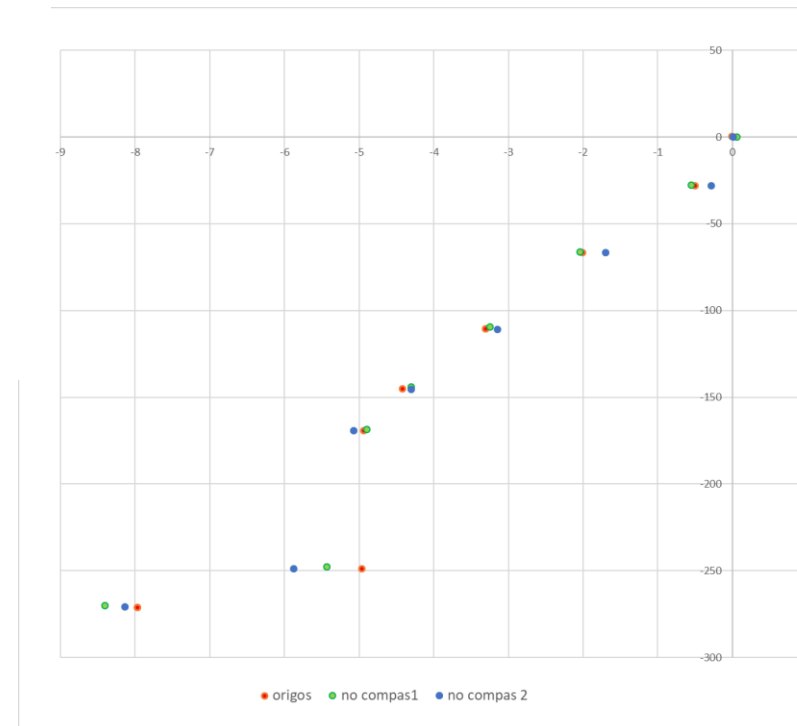
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Positional errors



Forget the GNSS

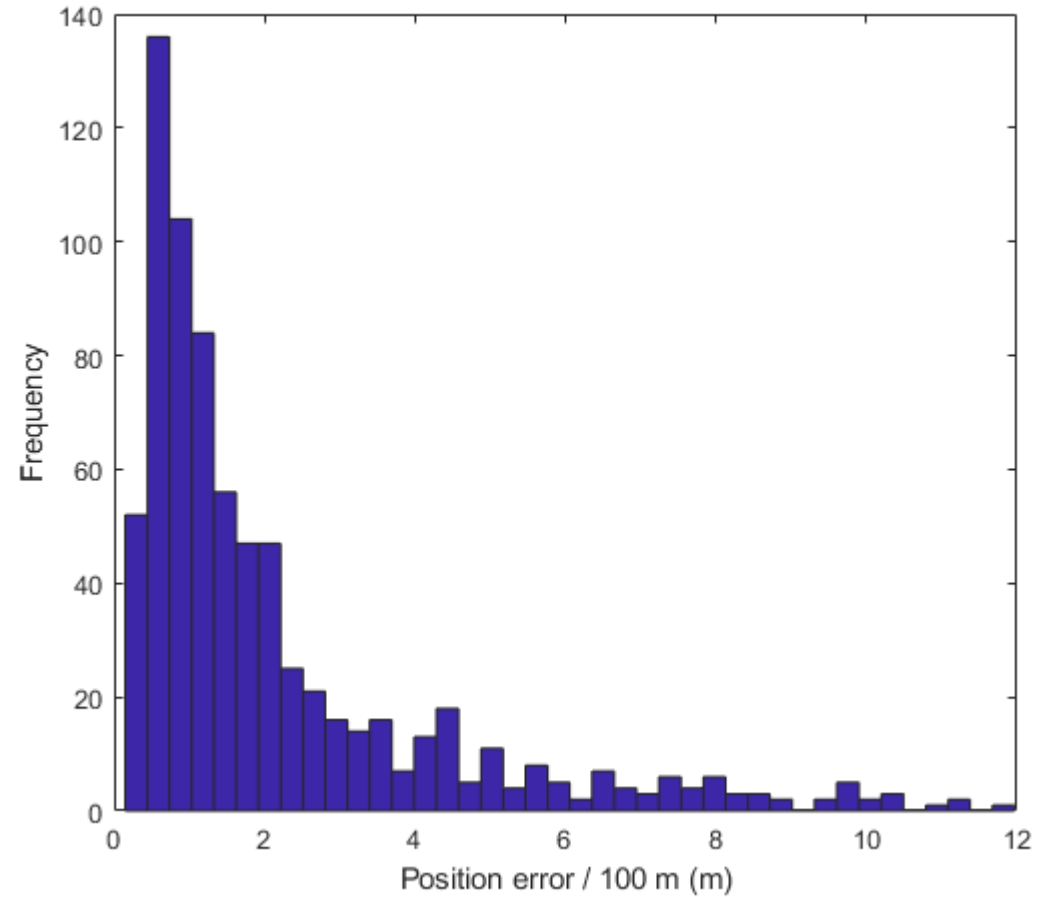




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Position error on 100 meter distance





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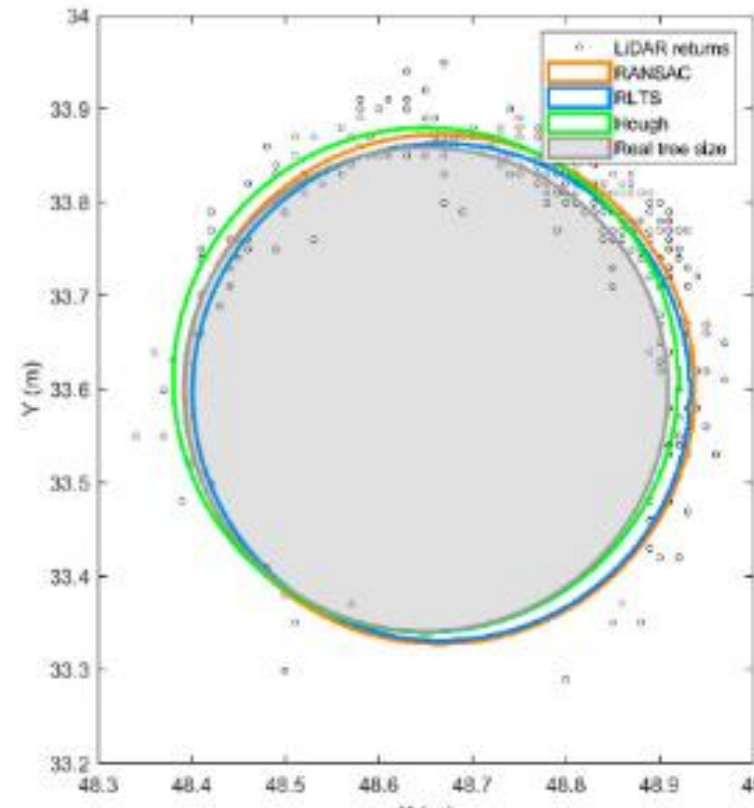


Diameter errors

Described in Martin's et al paper, but mostly to remember:

We work with circle fitting

Kuželka, K.; Slavík, M.; Surový, P. Very High Density Point Clouds from UAV Laser Scanning for Automatic Tree Stem Detection and Direct Diameter Measurement. Remote Sens. 2020, 12, 1236.





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- See the app?





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Anybody can do web content FACEBOOK



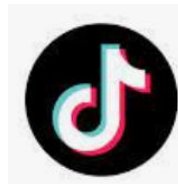
Anybody can do journalism TWITTER



Anybody can do photography INSTAGRAM



Anybody can do funny videos TIK TOK



Anybody can do video games ...?



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Virtual reality (VR)

Two dominant engines as of year 2022

Unity

Unreal



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Unreal Engine was developed by Epic Games founder Tim Sweeney in 1998.

It launched alongside its debut title, “Unreal,” and was unique in allowing players to modify the game for the first time.

Today Unreal is associated with “better graphics” and offers a big studio AAA-quality to the games that use it. Epic Games, the company behind Unreal Engine, has seen lots of success with its game Fortnite which has 200 million users and has generated revenue reported at \$1 billion as of January 2019. Unreal Engine itself has 7 million users.

Founded in Copenhagen in 2004, the founders of Unity wanted to make game development universally accessible. Today Unity is known as the “make any game” engine and is ideal for indie developers. Over 50% of games across all platforms use Unity and 60% of all VR/AR content is powered by Unity.

<https://blog.udemy.com/unity-vs-unreal-which-game-engine-is-best-for-you/>



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Unreal Engine

Modification of existing engine

LiDAR Point Cloud Plugin



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Unity Engine

Point Cloud Unity Plugin



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Matterport.



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360 images.