A Characterization of 3D Foot Scanning from Photogrammetry

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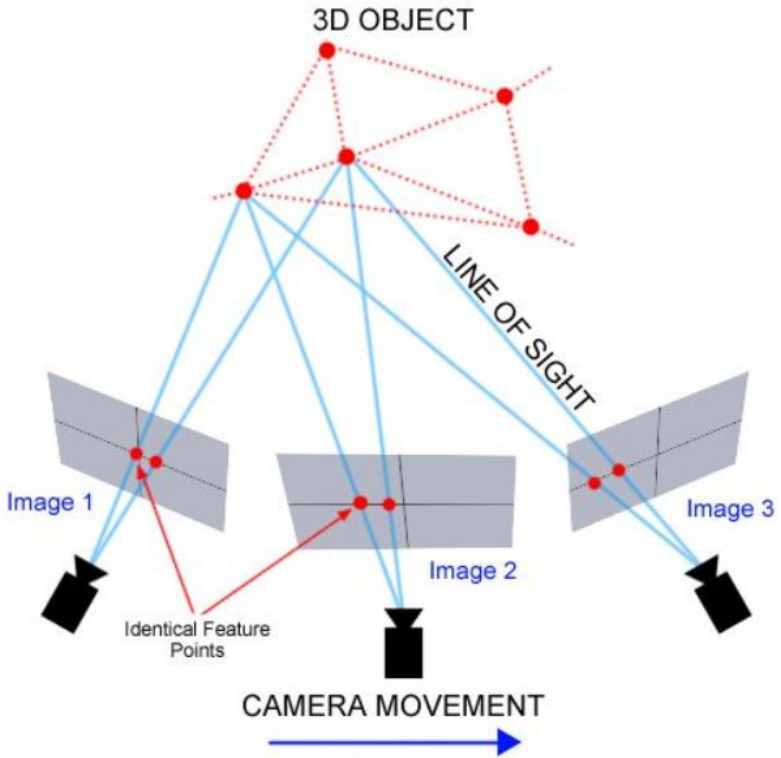
What is Photogrammetry



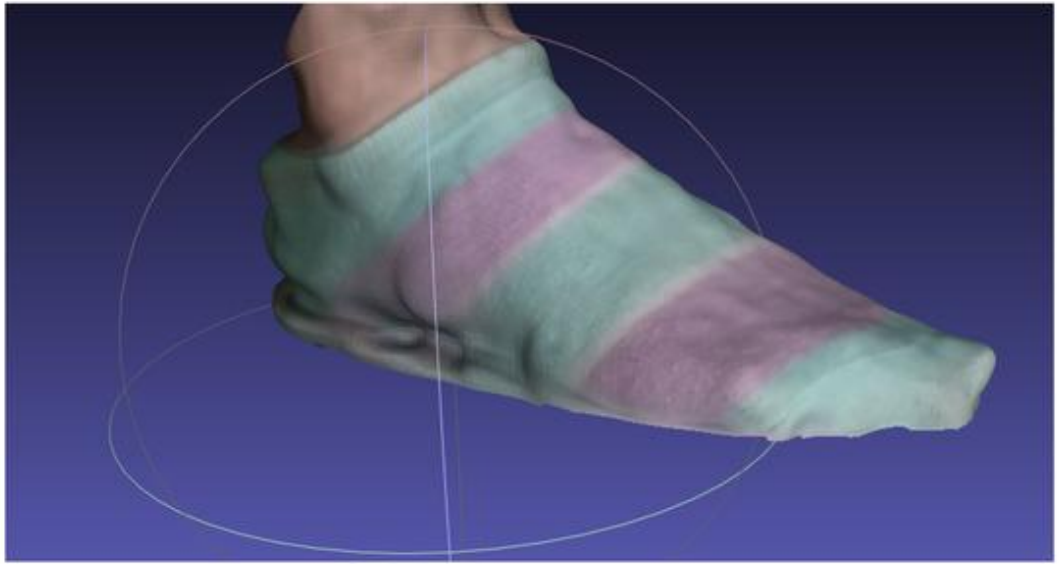
https://help.scanifly.com/definition-of-photogrammetry

Motivation - Why?

- Consumer Demand
  - Orthopedic shoes
  - Medical Diagnosis
  - Surgical Assistance
- Furthering Science
  - Foot Datasets
  - Prosthetics
  - Walking Analysis

Motivation - What's different?

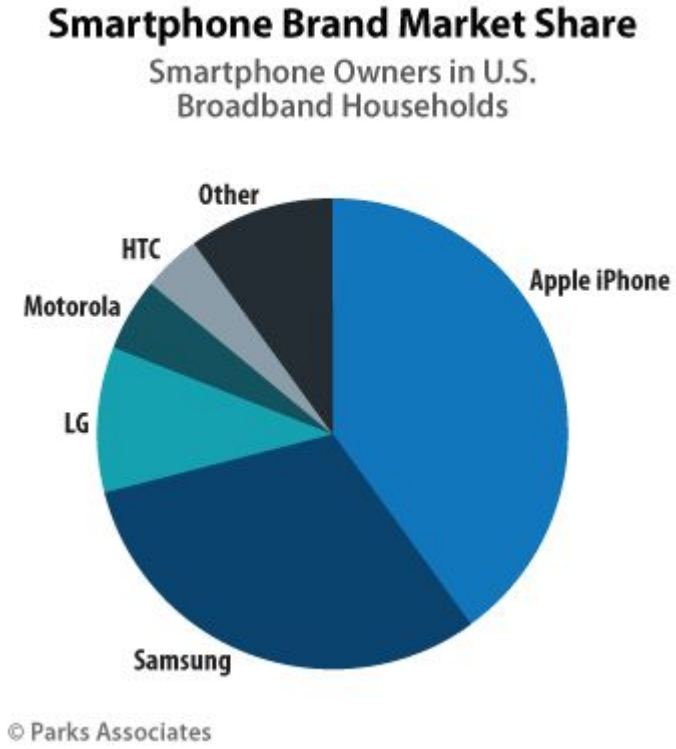
- Overall Volume is small
- Surface is uneven
- Not a rigid body
- Texture is not obvious
- Under arch gap



To balance ACCURACY and ACCESSIBILITY, we must compare the trade-offs

Quick Note - Why focus on Apple?

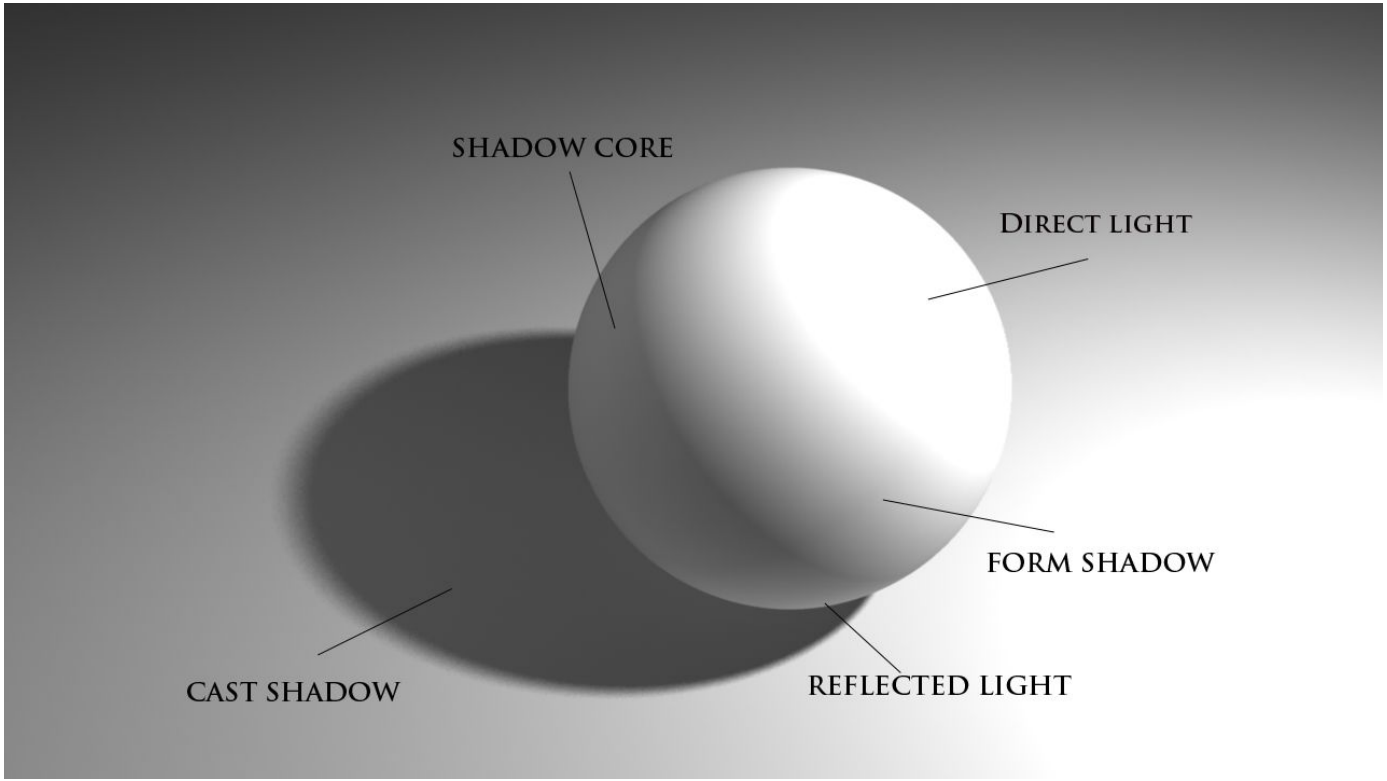
- Photogrammetry APIs
- Significant Market Share
- Consistency across devices



https://content.fortune.com/wp-content/uploads/2016/02/476885906137.gif

Choosing Devices

Setting the Environment



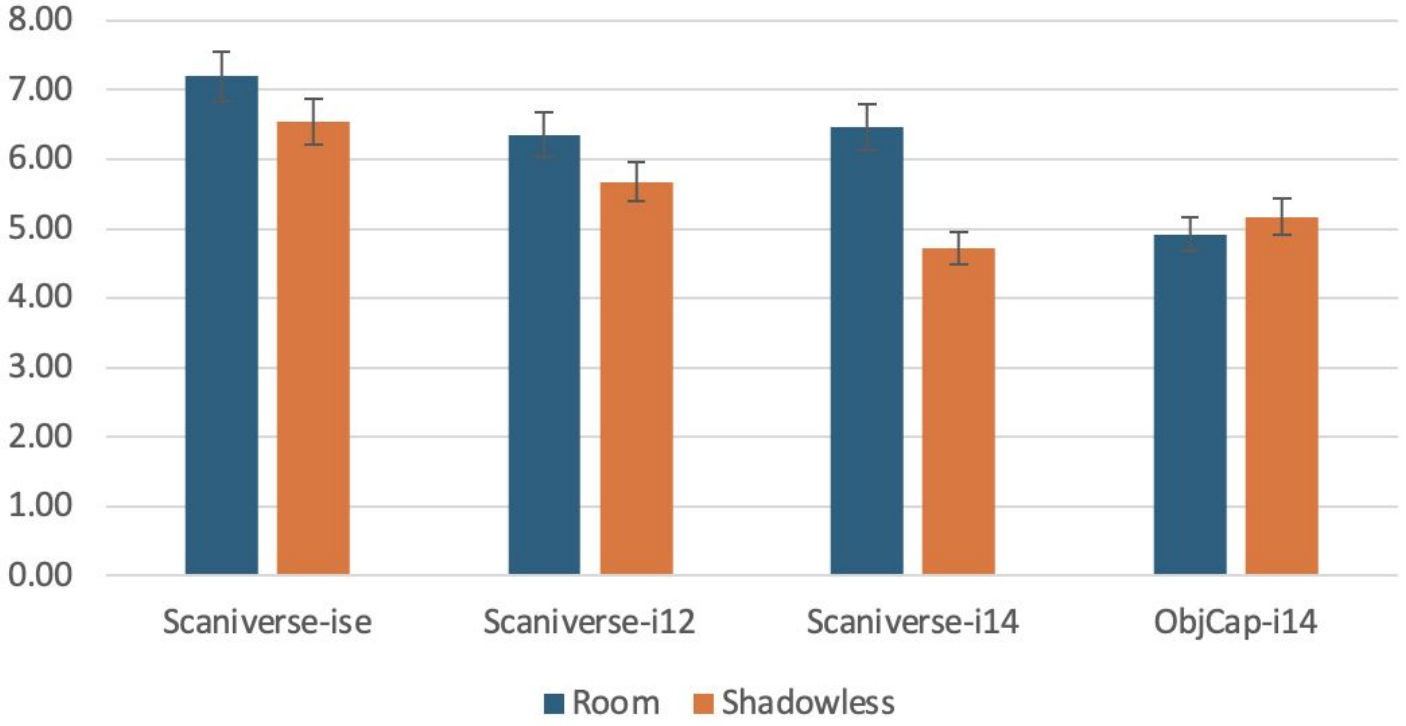
Reconstructed Models

Results - In Numeric Form

Type	Mean Hausdorff	Variance	Mean Absolute Err	Variance
Monoscopic	27.09	7.77	7.20	2.47
Stereoscopic	20.56	1.42	6.35	1.91
Stereoscopic Fusion	18.82	1.91	4.92	0.62
Monoscopic	25.93	5.62	6.54	2.80
Stereoscopic	24.40	3.53	5.67	1.93
Stereoscopic Fusion	18.70	2.19	5.17	0.39

Table 1: Error of each evaluated systems in different conditions. Error listed in mm

Results - Mean Absolute Error



Statistical Tests - Two-sample t-test

- Alpha = 0.05
- Comparison between shadow and fully lighted
  - Cannot reject null hypothesis
- Comparison between each category of technology
  - Can reject null hypothesis

Confidently say (95% certain) that as more cameras are added, the reconstruction gets better

In Summary

Photogrammetric Foot reconstruction is evolving

The phone proliferation with better cameras allow for apps to reconstruct body parts

More cameras are better in stereoscopic vision, LiDAR even better

Lighting doesn’t affect this technology significantly

Closing

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https://inspirationtuts.com/wp-content/uploads/2022/09/photogrammetry-and-3d-scanning-studio-1140x570.jpg