A Comparative Analysis of Sensor-, Geometry-, and Neural-Based Methods for Food Volume Estimation

MADiMa 2023

Lubnaa Abdur Rahman[1], Ioannis Papathanail[1], Lorenzo Brigato[1], and Stavroula Mougiakakou[1]
[1] University of Bern, Bern, Switzerland

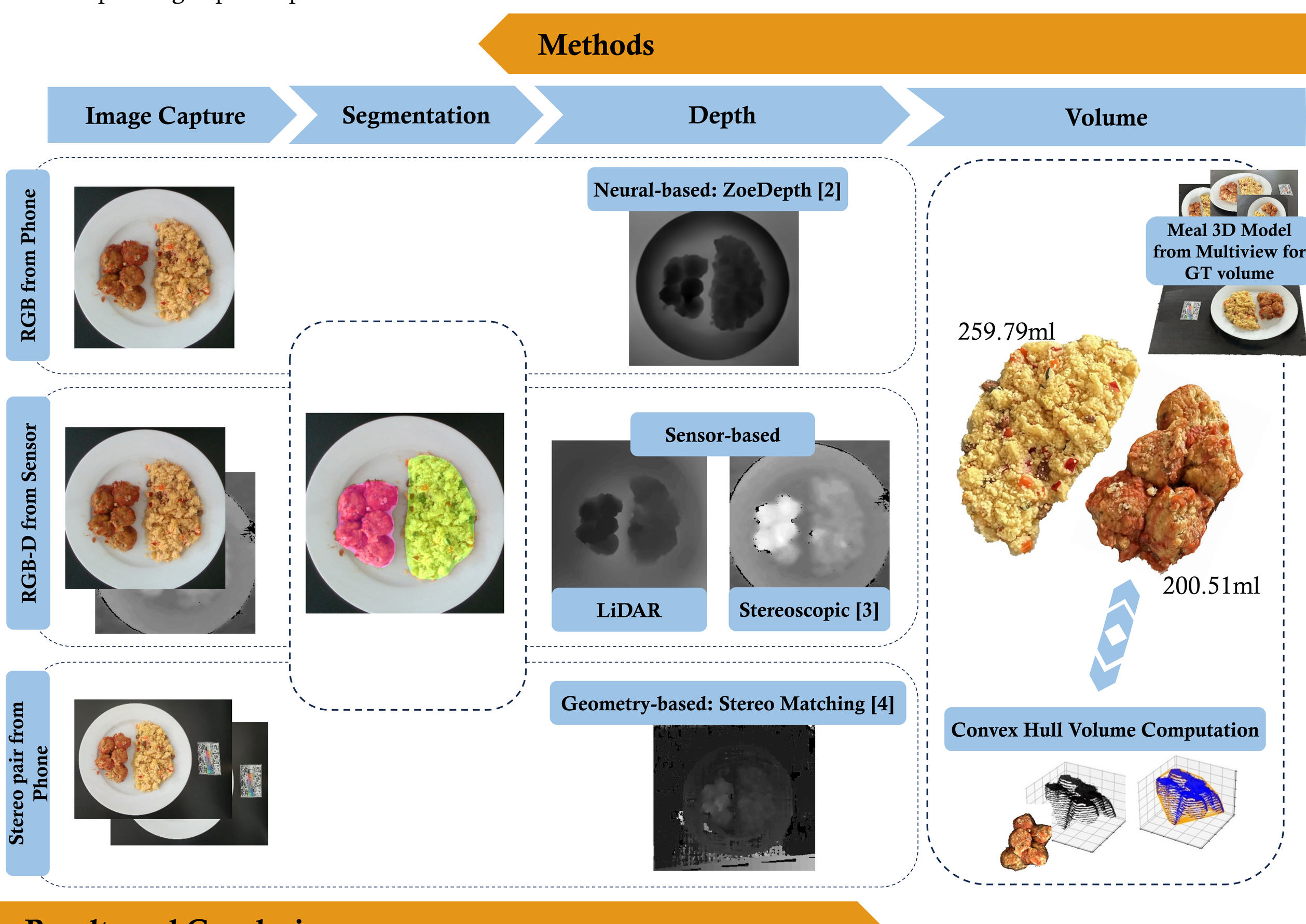
b UNIVERSITÄT BERN

MELISSA

Background and aims

- Automatic food volume estimation persists as a challenge with error rates as high as 85% [1].
- This study undertook a comparison of different methods for automatic food volume estimation harnessing depth maps as a pivotal component.
- A comprehensive dataset of 20 meals, captured at varying distances (40cm and 60cm) was curated encompassing reliable ground truth volumes, RGB images, and corresponding depth maps.

Methods



Results and Conclusions

- LiDAR consistently outperforms other methods, offering reliability and flexibility.
- The stereoscopic sensor, ranking second at 40cm, could be ideal for controlled environments.
- The geometry-based method excels particularly at 60cm.
- Neural-based approach shows promise, needing only one image and no specific hardware but may benefit from further fine-tuning.

Method	Plastic		Real	
	40 cm	60 cm	40 cm	60 cm
Stereoscopic sensor	26.15	36.41	25.06	41.07
LiDAR sensor	**21.32**	**22.76**	**17.45**	**16.40**
Geometry-based	30.54	29.99	27.21	23.57
Neural-based	30.40	35.61	26.41	30.25

***Table 1**: Mean absolute percentage errors with different methods*

Acknowledgments

This work was partly supported by the European Commission and the Swiss Confederation - State Secretariat for Education, Research and Innovation (SERI) within the project 101057730 Mobile Artificial Intelligence Solution for Diabetes Adaptive Care (MELISSA)

References

[1] https://doi.org/10.3390/healthcare11010059
[2] https://doi.org/10.48550/arXiv.2302.12288
[3] https://doi.org/10.3390/nu13124539
[4] https://doi.org/10.3390/s20154283