embedded VISION SUMMIT 2018

Data-Driven Business Models Based on 3D Technologies

FRAMOS

Dr. Christopher Scheubel

22.5.2018

We have provided imaging solutions for 36 years

More than 36 years of imaging experience

- Founded in 1981
- Employees: 150
- Sales Volume ~ 50 Mio. EUR
- The only global imaging partner from sensor to system
- Development of our own embedded technologies
- Team of 40 engineers

Technology revolutions always bring winners and losers

SOURCE: Andrew H. Walker / Stringer / Getty; Twitter

Source: Link

NETFLIX

BLOCKBUSTER

Spotify

ascap

BMI
BROADCAST MUSIC, INC.

in

SpencerStuart

Kienbaum

KORN FERRY

Hypothesis: Currently, winners gain competitive edge based on data

Def_Business Model

A business model describes the rationale of how an organization creates, delivers, and captures value

Source: A. Osterwalder & Y. Pigneur (2010), Link

Winners in the world of data:

1. **Apply and combine technology** that enables better or new solutions
2. **… that generate data …**
3. **…** and, in turn, provide a **significantly better user experience (competitive advantage)**

Data provides the competitive edge

	Spotify	LinkedIn
Application of technology	Streaming of audio content / cross-device / any time	Network to promote oneself professionally
That generates data	Data on which content is streamed where, by whom and on which device	Career path of person profiles with company profiles
Significantly better user experience	Optimized content suggestions for customers, market insights to artists	Prospect suggestions with much higher success rate

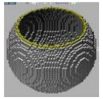
3D is a key technology to discover such business models

3D data

Depth Map

Point Cloud

Voxels



Methods

Object Recognition

Obstacle Recognition

SLAM (Navigation)

Pose Estimation

Dimensioning

Applications

AR/VR

Robotics

Drones

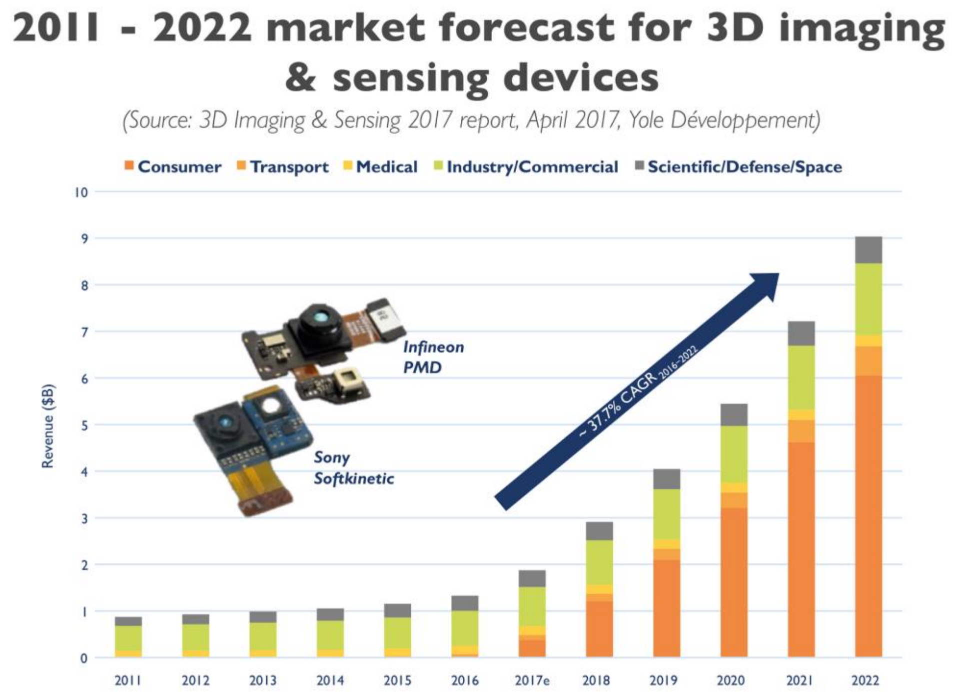
Logistics/Industry

Automotive

Surveillance

Gesture control

Consumer applications will drive 3D market growth

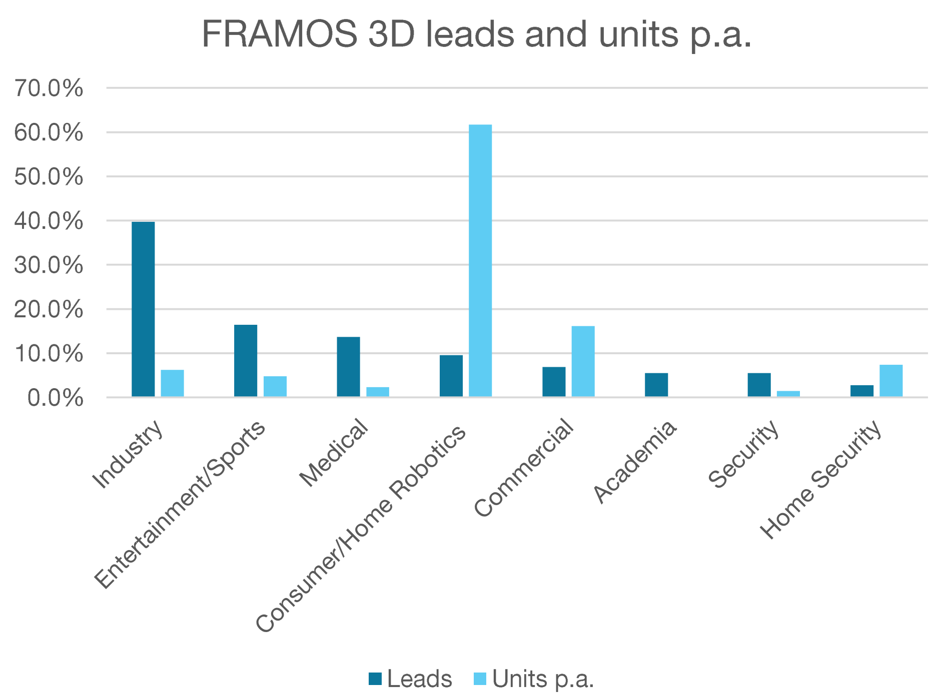


Source: YOLE

- 3D imaging and sensing devices are expected to grow at a CAGR of 38% until 2022
- Main absolute growth will come from consumer as well as industrial/commercial applications
- Rise of 3D is spurred by technology progress and declining prices

FRAMOS

We recognize a lot of 3D opportunity in various industries



- Most of the leads in 3D that we receive come from the industrial field (factory, farming, logistics automation)
- However, concerning the volume measured in units p.a., the most relevant sectors are home robotics and commercial applications

3D enables collaborative robotics

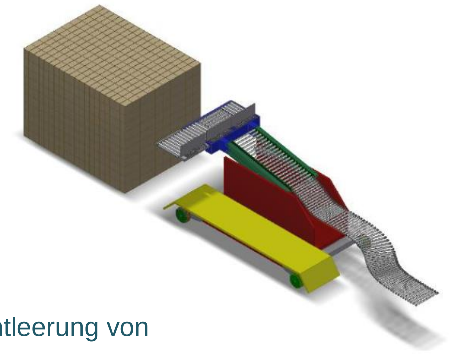
FRAMOS Installation, Munich Hospital, Rechts der Isar

Technology: 3D camera with marker-based tracking (pose estimation)

Application: Collaborative robotics in the area of medicine and industry

Edge: Database for pose-estimations and use of AI to improve accuracy

3D enables automatic container unloading



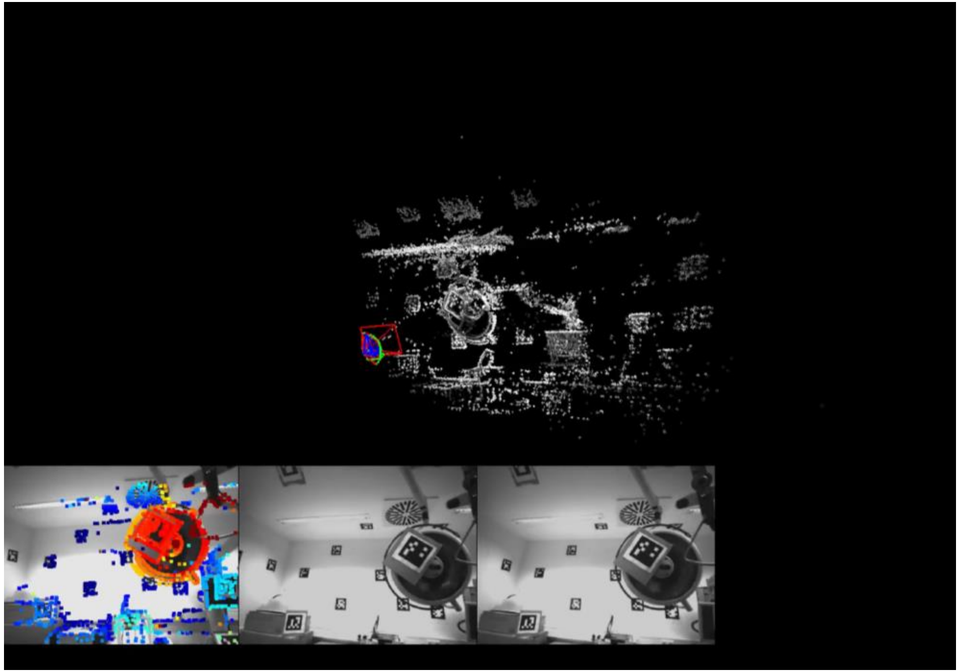
IRiS – „Interaktives Robotiksystem zur Entleerung von Seecontainern“

Technology: 3D camera for depth calc. and dimensioning, semantic segmentation to distinguish objects

Application: Unloading of trucks and containers

Edge: Data to optimize the system accuracy, data on flow of goods

3D enables autonomous navigation (I/II)



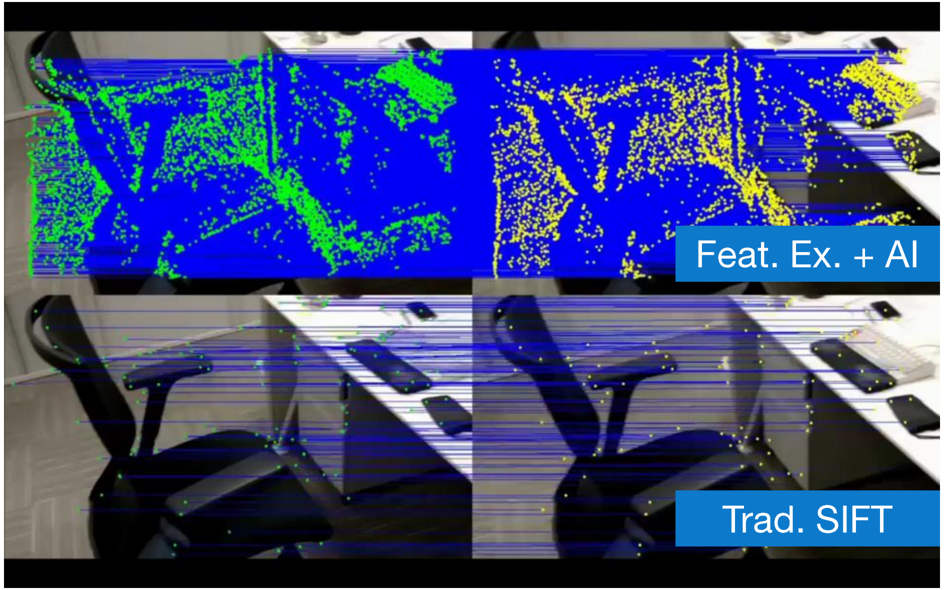
B. Busam, P. Ruhkamp et al. [under review], FRAMOS

Technology: SLAM + AI to create 3D maps

Application: Navigation for UAVs, home robots, logistics robots

Edge: 3D maps of the world, outside and inside

3D enables autonomous navigation (II/II)



B. Busam, P. Ruhkamp et al. [under review], FRAMOS

SLAM + AI provides technological edge

Technology: SLAM + AI to create 3D maps

Application: Navigation for UAVs, home robots, logistics robots

Edge: 3D maps of the world, outside and inside

Recommendations

1. **Apply 3D technologies to your application for collaborative robotics, navigation, dimensioning … etc.**
2. **Generate a 3D database (and make use of AI)**
3. **Discover a business model that uses the database to create a significantly better user experience**

Resources

embedded VISION SUMMIT 2018

Visit the FRAMOS Technology Showcase

FRAMOS Imaging Center https://www.framos.com/en/imaging-center/ (Case Studies, Specialized Articles, Whitepapers & Expert Interviews)

Stereo Vision: Facing the Challenges and Seeing the Opportunities for ADAS Applications, Embedded Vision Alliance Resources

Vision Processing Opportunities in Drones, Embedded Vision Alliance Resources

"The Evolution of Depth Sensing: From Exotic to Ubiquitous," a Presentation from 8tree, Embedded Vision Alliance Resources

"How 3D Maps Will Change the World," a Presentation from Augmented Pixels, Embedded Vision Alliance Resources

Hartmann, P. M., Zaki, M., Feldmann, N., & Neely, A. (2014). Big data for big business? A taxonomy of data-driven business models used by start-up firms. *A Taxonomy of Data-Driven Business Models Used by Start-Up Firms (March 27, 2014)*.

Sorescu, A. (2017). Data-Driven Business Model Innovation. *Journal of Product Innovation Management*, *34*(5), 691-696.

Osterwalder, A., & Pigneur, Y. (2010). Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons.

Resources

Dou, M., Khamis, S., Degtyarev, Y., Davidson, P., Fanello, S. R., Kowdle, A., ... & Kohli, P. (2016). Fusion4d: Real-time performance capture of challenging scenes. ACM Transactions on Graphics (TOG), 35(4), 114.

Birdal, T., Busam, B., Navab, N., Ilic, S., & Sturm, P. (2018). A Minimalist Approach to Type-Agnostic Detection of Quadrics in Point Clouds. *arXiv preprint arXiv:1803.07191*.

Li, Y., Pirk, S., Su, H., Qi, C. R., & Guibas, L. J. (2016). Fpnn: Field probing neural networks for 3d data. In Advances in Neural Information Processing Systems (pp. 307-315).

Zeng, W., & Gevers, T. (2017). 3DContextNet: Kd Tree Guided Hierarchical Learning of Point Clouds Using Local Contextual Cues. *arXiv preprint arXiv:1711.11379*.

Monti, F., Boscaini, D., Masci, J., Rodola, E., Svoboda, J., & Bronstein, M. M. (2017, July). Geometric deep learning on graphs and manifolds using mixture model CNNs. In *Proc. CVPR* (Vol. 1, No. 2, p. 3).

Esposito, M., Busam, B., Hennersperger, C., Rackerseder, J., Navab, N., & Frisch, B. (2016). Multimodal US–gamma imaging using collaborative robotics for cancer staging biopsies. *International journal of computer assisted radiology and surgery*, *11*(9), 1561-1571.

Zbontar, J., & LeCun, Y. (2015). Computing the stereo matching cost with a convolutional neural network. In *Proceedings of the IEEE conference on computer vision and pattern recognition* (pp. 1592-1599).