

Automatic Alignment of 3D Objects in Augmented Reality

Augmented Reality (AR) is a user interface paradigm to seamlessly integrate virtual information into the real world view, whereby both the virtual and the real are spatially registered in 3D [1]. Thereby most AR applications additionally calls for precise alignment of the superimposed object to its real counterpart. Normally this is laboriously done by manual fine-graded adjustments in six degrees of freedom. While some approaches provide alignment by simple user interaction [2], other approaches introduce autonomous snapping techniques using physical constraints of the real world view [3]. The objective of this work is to implement an automatic alignment approach to bring a 3D virtual object in line with the real object as precisely as possible.

Literature Project (LP): <i>Alignment of 3D Objects in AR</i>	- review and describe existing approaches for automatic alignment of 3D objects in AR [2, 3]
Software Project (SP): <i>Snapping AR Objects to Reality</i>	- implement the snapping approach of Nuernberger et al. [3] - evaluate the snapping technique - identify weaknesses and discuss improvements
Master Thesis (MA): <i>Automatic Alignment of 3D Objects in AR</i>	- implement an automatic alignment approach based on the results of the software project - evaluate the resulted alignment accuracy - discuss the constraints, disadvantages and advantages of your alignment approach

Qualifications:

- Good programming skills (C++, Unity)
- Interested in computer vision and computer graphics
- Ability to work independently

Literature:

- [1] Azuma, R.T. (1997) A survey of augmented reality. *Presence, Teleoperators and Virtual Environments*, 6(4), pp. 355-385.
- [2] Close, B.S., McCulley, D. and Thomas, B.H. (2010) Late breaking results: ARPipes : aligning virtual models to their physical counterparts with spatial augmented reality. In Proc. of the 20th International Conference on Artificial Reality and Telexistence (*ICAT'10*), pp. 226–227.
- [3] Nuernberger, B., Ofek, E., Benko, H. and Wilson, A.D. (2016) SnapToReality: Aligning Augmented Reality to the Real World. In *Proc. of the 2016 CHI Conference on Human Factors in Computing Systems (CHI'16)*, pp. 1233–1244.

Book: Schmalstieg, D. & Höllerer, T. (2016) *Augmented Reality: Principles and Practice*. Addison Wesley.

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