New methods for realistic and comfortable experiences in AR – University of Genoa

Curriculum: Industry 4.0

Hosting Institution: University of Genoa

Department: Department of Informatics, Bioengineering, Robotics, and Systems Engineering (DIBRIS)

Tutors:
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Description:
Optical see-through (OST) augmented reality head-mounted displays (HMD) have emerged as a key asset in several application fields. In OST HMDs the direct view of the world is mostly preserved and there is no perspective conversion in viewpoint and field of view, as with video see-through (VST) systems. This aspect confers a clear advantage over VST solutions, particularly when used to interact with close objects. Although there have been significant improvements to performance and comfort of OST HMDs, limitations associated with human perception still remain to be addressed. In order to provide the user with a realistic, natural and comfortable visual experience, a thorough and accurate knowledge of eye characteristics and HMD geometry must be assumed. These quantities are usually calibrated on a per-device and per-user basis, or modeled from scientific literature. A deviation of the actual values from the expected ones can result in incorrect camera placement, spatial distortions and non-uniformities, thus triggering discomfort in VR/AR.
The goal of this research project is to develop methods and techniques to assess and mitigate discomfort and perceptual inconsistencies between real and augmented visual content in OST HMDs. A joint experimental and modeling approach will be followed in order to:

1. investigate methods to evaluate different sources of discomfort/mismatch;
2. develop subjective and objective methods to quantify the originated discomfort;
3. investigate strategies to mitigate the sources of discomfort/mismatch in AR/VR devices.

Requirements:
Applicants are expected to: 1) have a keen interest in Vision Science and in Augmented Reality, 2) have good programming skills in at least one language (Matlab, C/C++, Python, C#), 3) work well in group problem solving situations, 4) have intermediate communication skills (oral and written) in English or better. Experience in Unity 3D is a plus.

References:

[1] Konrad, R., Angelopoulos, A., & Wetzstein, G. (2020). Gaze-contingent ocular parallax rendering for virtual reality. ACM Transactions on Graphics (TOG), 39(2), 1-12
[2] Lambooij, M. T., IJsselsteijn, W. A., & Heynderickx, I. (2007). Visual discomfort in stereoscopic displays: a review. Stereoscopic Displays and Virtual Reality Systems XIV, 6490, 183-195.
[3] Gibaldi A., Liu Y., Kaspiris-Rousellis C., Mahadevan M., Vlaskamp B.NS, Maus G.W. Vertical vergence and screen alignment with see-through head-mounted displays. ECVP 2023.

Company name and link (for industrial projects):
Magic Leap Inc. (www.magicleap.com)

Number of positions available: 1

Main Research Sites
1. DIBRIS, via Opera Pia 13, 16145 Genoa, Italy, **2.** Macic Leap Inc., Andreasstrasse 5, 8050 Zürich, Switzerland

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