# ARES - Augmented Reality Enabling Superhuman Sports + Serious Games (2nd Annual Workshop)

In the last years, the usage of Augmented Reality (AR) advanced into new frontiers through the widespread adoption of affordable mobile devices. For example, in Superhuman Sports, AR provides the potential to be a driving factor by revolutionizing team sports or by introducing novel game mechanics. In the field of Serious Games, AR can bring 3D serious content into the physical world to enhance immersion and knowledge transfer. In both areas, the full potential of this vision-based technology is still limited through the lack of framework support and tangible controller feedback for purely virtual objects.

We want to bring together experts from different computing and engineering disciplines to overcome the barriers of complex AR game concepts and to enhance interactions with augmented objects in a playful way in two important research fields:

The goal of *Superhuman Sports* is to surpass the limitations of the human body by incorporating technology. Cognitive and physical capabilities are augmented by involving rich interactions through tangible and virtual game objects. Concepts of team sports based on competition and the exploration of new experiences through novel senses and reflexes, are helping to augment traditional sports or to path the way towards new game ideas.

*Serious Games* combine the world of playing games for entertainment with the goal of learning in an almost subconsciously manner. Combining these two approaches requires meeting the demands of both. Learning content must be presented correctly and coherently, but on the other hand, it must be perfectly integrated into a game concept.

Today, there are still various unsolved and related challenges for AR sports concepts and AR Serious Games alike, which should be spontaneously, anywhere, playable on mobile/wearable devices. Major challenges include, but are not limited to:

- **AR Multiplayer Framework:** Reliably connecting mobile devices and supporting versatility in terms of augmentation platforms, is still an open issue. In a game engine such as Unity, there is up until this day a limitation in supporting self-made tracking algorithms, e.g., machine learning-based ones. On the other hand, game engines provide the important capability to efficiently render virtual content and provide the central game logic. We want to propose building blocks to solve such limitations and bring together mobile and microcontroller platforms into an AR framework.
- **Tangible and Augmented Game Objects**: Traditionally, purely virtual game objects are used in AR games, because they can be easily manipulated in 3D space and hence require no tracking pipeline. On the other hand, they don't offer rich haptic feedback. To achieve realistic interactions, a combination of tangible and augmented game objects such as sports equipment or Serious Game objects are required. In this workshop we want to explore the realization of these rich tangible experiences.

- **HMD Technology:** There is a vast gap in quality between cheap smartphone-based augmentation and sparsely available HMDs. During the workshop we want to emphasize development in the direction of novel display solutions and sensors to realize truly mobile AR experiences for dynamic game scenarios.

As coordinators we will contribute to the workshop by presenting unique Superhuman Sports and Serious Games concepts. In *Catching the Drone* [1], two teams are competing against each other by first catching an evasive, intelligent game ball, in the form of a custom designed drone which is augmented and thrown through the enemy team's goal with the help of superhuman moves. To improve force feedback in MR ball games, we are demonstrating research on an *AR Tennis* [2] bat based on brushless engines for simulating precise ball impacts. Furthermore, we present the utilization of AR in Serious Games in various context directions with developed examples such as language learning [3] and cultural heritage. We describe challenges we faced and some solutions we found to spark an active discussion with the participants. Further research is included through the submitted papers which have been reviewed to fit in the scope of the workshop:

**Topics in the area of AR Sports include, but are not limited to:**

- Novel AR Superhuman Sports game ideas
- Innovative augmented game objects
- AR sports training concepts
- Frameworks for multiplayer AR applications
- HMD technology for dynamic AR games
- Technology for sensory augmentation
- Sports field enhancements
- Audience integration into MR sports

**Topics in the area of Serious Games include, but are not limited to:**

- Education
- Languages
- Natural Sciences
- Cultural Heritage
- Health
- Economy
- Politics

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**Contribution Formats:**

- Research and position papers (4-6 pages)
- Work-in-progress papers (2-3 pages)

All paper submissions must be in English. All submissions must be prepared in IEEE Computer Society VGTC format (http://junctionpublishing.org/vgtc/Tasks/camera.html)
and submitted in PDF format. We highly encourage authors to use the LaTeX template. However, authors who choose to use the MS Word template should ensure that the PDF submission matches the PDF format template (http://junctionpublishing.org/vgtc/Templates/october2017/vgtc_conference_latex.pdf).

All papers and camera-ready versions have to be submitted electronically via precision conference

Submissions will be reviewed by at least 2 PC members following a single-blind review process. Accepted papers will be given guidelines in preparing and submitting the final manuscript(s) together with the notification of acceptance.

**Deadlines & Dates**

- Paper Submission Deadline: tba
- Notification of acceptance: tba
- Camera-ready Deadline: tba
- Workshop day: tba

IEEE VR Workshops proceedings will be published electronically through the IEEE Digital Library dependent on the on-time submission of the proceedings by the workshop organisers,
before the mandatory IEEE deadline of tba

**Workshop Format**

The workshop will be held online and will take half a day. Accepted contributions will be organized in a session consisting of presentations and discussions.

**Website:** https://wiki.tum.de/pages/viewpage.action?pageId=1003688592

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[1] Eichhorn, C., Jadid, A., Plecher, D. A., Weber, S., Klinker, G., & Itoh, Y. (2020, November). Catching the Drone-A Tangible Augmented Reality Game in Superhuman Sports. In 2020 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct) (pp. 24-29). IEEE.

[2] Eichhorn, C., Plecher, D. A., Inami, M., & Klinker, G. (2019, March). Physical Objects in AR Games–Offering a Tangible Experience. In 2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR) (pp. 1801-1806). IEEE Computer Society.

[3] Plecher, D. A., Eichhorn, C., Kindl, J., Kreisig, S., Wintergerst, M., & Klinker, G. (2018, October). Dragon tale-a serious game for learning japanese kanji. In *Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts* (pp. 577-583).