Interactive AR System for Origami

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This thesis describes an interactive AR system for origami. We designed a tangible user interface that seamlessly connects the virtual environment and the physical world to augment the origami experience. Origami created by the user is augmented through the AR glasses, and the user can manipulate the superimposed virtual objects.

The goal of this research is to enhance the enjoyment of new origami experiences. To this end, we added digital information to origami created in the physical world and constructed an interactive interaction using augmented reality (AR) and 3D origami shape recognition.

To ensure stable superposition accuracy, we searched for the optimal method of embedding AR markers in origami paper and used highly random patterns as AR markers. By using multiple AR marker patterns embedded in origami paper, we were able to achieve multifaceted origami shape recognition. Recognition of multiple markers, the coordinates and angles of each marker, and recognition of the detailed shape of the origami paper enabled interaction with computer graphics through shape changes. The AR markers are placed all over the origami paper, and the user can change the pattern of the AR markers depending on how he or she folds the paper.

We conducted an evaluation experiment, and the results showed that the participants who experienced this system enjoyed it and were motivated to try origami. Compared to regular origami, 90% of participants said they would like to try origami again, indicating a significant increase in motivation for the experience. Participants were highly satisfied with the experience of being able to influence the outcome of the virtual reality through the act of folding origami in the real world, the manipulation of the CG according to their movements, and the CG design that changes depending on the folded artifact. The difficulty of the experience and the level of stress caused by the experience were not significantly different from those of regular origami. Furthermore, it was shown that the design of natural AR markers that match the surrounding landscape can be used to construct a system that allows users to enjoy augmented reality through origami in a more natural way.

The advantages of the proposed method include the ability to experience AR using only simple tools, AR experiences that take advantage of the user's creativity, interaction with virtual information, and the high scalability of AR. It is suggested that the proposed method can be used for education, therapy, entertainment, marketing, etc.