

Spatially Enhancing Historic Image Artifacts in Cultural Heritage with Machine Learning in WebXR

Style Transfer and Monocular Depth Estimation for Cultural Heritage Storytelling

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Introduction

We are presenting our series of machine learning based enhancements of cultural heritage image artifacts. The goal of the series is the application of style transfer and depth estimation in the field of cultural heritage through the transmission of historical image styles into 3D presentation formats. This provides the audience an immersive experience, going beyond traditional representations, such as historic photographs and paintings, which mostly appear limited and two-dimensional.

The preservation of cultural heritage is important to promote awareness and appreciation of history. In recent years, innovative technologies, such as Virtual and Augmented Reality (VR/ AR) have created new ways to explore and experience cultural heritage in immersive and interactive ways. By using recent machine learning approaches style transfer algorithms, we were able to apply the styles of historic imagery to nowadays panorama captures of the locations. We created immersive WebXR (MacIntyre and Smith 2018) experiences, so users can relive the locations through the eyes of the historical styles of that time.

Technology

To achieve this, we are implementing a range of available machine learning approaches for editing and presenting the visual artifacts for our cultural heritage stories by using Google Colaboratory (Colaboratory 2017) notebooks with Nvidia A100 GPUs for all our experiments.

The technique of arbitrary neural artistic stylization network (Ghiasi et al. 2017) translates the style of a reference image onto a 360° panorama image. Applying MiDaS (Ranftl et al. 2022) monocular depths estimation we create scene depth from an input image we are applying with a displacement shader on a plane textured with the historic image to get a stereo-image like spatial impression of the historic scene.

Implementations

We are presenting three applications of our concept. In "Ludwig-Main-Danube Canal" we are interactively juxtaposing different aspects such as geography, history and economy embedded in the aesthetics of historic steel engravings of the canal (see Fig. 1). Next, we are spatially telling the stories of deported Jewish inhabitants behind the brass stumbling blocks in German cities by colorizing and extruding the depth (see Fig. 2). And last, we are transferring the styles of historic drawings

of the Franconian rock maze “Luisenburg” onto current interactive 360° panorama images (see Fig. 3).

References

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