# 3D generative models based on NeRF representation

Virtual Reality (VR) is one of the key emerging technologies that underpin the ongoing digital transformation that spans various industries and businesses, including medical, education, engineering, and other sectors. We can observe that VR technology already has very high and rapidly growing traction, expanding its scope rapidly to new applications.

However, one of the critical challenges for VR and its subsequent mass-market adoption is the lack of appropriate application-specific content. Here, the main difficulty is creating realistic, high-quality and rich content, i.e., models of objects and other assets or whole scenes, used to populate the VR environments.

In this context, the *Neural Radiance Fields* (NeRFs) offer the most promise of becoming the pivoting approach in the context of VR content creation, see Fig. 1. NeRFs can generate photorealistic 3D environments from a handful of user-obtained photographs and other image-based data. Thus, enabling unique possibilities for VR experiences by allowing one to populate VR scenes with the user's own high-quality imagery data.

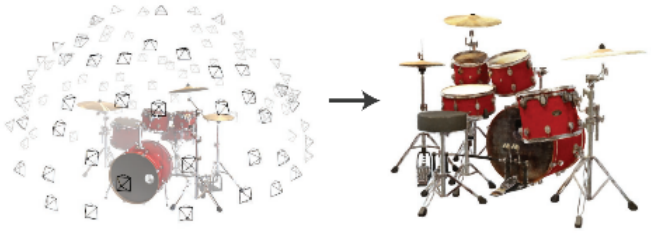

Figure 1: On the input, NeRF takes a few existing images from different positions. NeRF algorithm produces novel views.

NeRFs enable novel views of complex scenes to be synthesized from a few 2D images with known camera positions, see Fig. 1. This neural network model can render high-quality scene views from previously unseen viewpoints based on the relations between those base images and computer graphics principles, such as ray tracing. Although in recent years much effort has been invested in improving the quality of the resulting views and the controllability of NeRFs, the robustness of these methods against various data registration challenges remains a largely unexplored research area. Moreover, currently, the NeRF architecture has several significant limitations. For example, the NeRF model must be trained on each object separately, and it does not generalize to unseen objects. The training time is long, since we encode the shape of the object in neural network weights, and the training imagery data must be obtained from various distances from the asset in question. Furthermore, producing controllable NeRF, or a model dedicated to dynamic scenes is not trivial. These underlined problems have grave consequences when we create generative models dedicated to 3D objects represented by NeRF that we plan to tackle through the proposed research program.

**The project's main idea is to construct new *representation in NeRF* to solve a fundamental problem in NeRF model and use such new representations in generative models.**

Generative models obtained in the grant will be used to produce content for the VR environment.