CfACTs Introduction Framestore is a world leading visual effects company, producing award winning content within the domains of feature film, long form, commercial and interactive entertainment. Framestore's Rendering Team develops and supports the software used for rendering our production quality visual effects and includes our in-house renderer 'Freak', state-of-the-art shader libraries, and artist focused rendering tools that are used globally across all of Framestore's film projects. We believe there exists an opportunity for practical, production focused innovative research that can both extend the domain of knowledge and directly impact the quality and efficiency of the imagery that we create. We envisage, by allowing researchers to leverage our cutting edge workflows and technologies, and use our production level datasets, we can inspire, accelerate and focus innovation that can be applied within the production context.

Application of Machine Learning to Problems in Light Transport

Introduction High end visual effects production demands ever more convincing and complex imagery. This often includes difficult to solve light transport situations such as nested dielectric media, volumetric multiple scattering and complex lighting scenarios. Typical approaches, such as forward path tracing, struggle with many important transport types and computation times for reaching acceptable levels of variance can be significant. We would like to research the application of machine learning (ML) techniques to solve and accelerate these difficult to compute scenarios. In order to be applicable to production rendering, important considerations include temporal coherency, scalability and user control. Key areas of interest include transport through highly scattering media, such as clouds and white fur, and efficient computation of specular-diffuse-specular paths.

Literature Current research follows two main approaches, progressive reinforcement learning (Muller, 2017) or techniques using deep neural networks, both online (Muller, 2019) and offline (Bako, 2019). (Kallweit, 2017) focusses on the particular challenge of volumetric light transport. (Zhu, 2020) provides a general survey of the current field.

References *Bako, S., Meyer, M., DeRose, T., & Sen, P. (2019). Offline Deep Importance Sampling for Monte Carlo Path Tracing. Computer Graphics Forum, 38.Kallweit, S., Müller, T., McWilliams, B., Gross, M., & Novák, J. (2017). Deep scattering. ACM Transactions on Graphics (TOG), 36, 1 - 11.Müller, T., Gross, M., & Novák, J. (2017). Practical Path Guiding for Efficient Light-Transport Simulation. Computer Graphics Forum, 36.Müller, T., McWilliams, B., Rousselle, F., Gross, M., & Novák, J. (2019). Neural Importance Sampling. ACM Transactions on Graphics (TOG), 38, 1 - 19.Zhu, S. (2020). Survey: Machine Learning in Production Rendering. ArXiv, abs/2005.12518.*

Deliverables Working within our in-house renderer Freak, research and prototype methodologies that leverage ML to provide progressive, controllable and temporally coherent acceleration of light transport across production datasets.

Impact This work has the potential to have a direct and significant impact on the quality and efficiency of rendered imagery in the production environment. As well as providing a practical state-of-the-art approach for production quality visual effects rendering, this allows a new level of fidelity and realism to be reachable within visual effects.