Thesis Project Portfolio

Research Analysis: NeRF

(Technical Report)

State Your Full Name for The Record: Privacy Rights and Practices in the Digital Age

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

Generating Novel Views of Complex Objects

In the US today, over 93% of all adults are connected to the internet. They engage in online retail, social media, and many other common activities. Through these transactions they expose themselves to data collection, and as tools for metadata analysis become exponentially more sophisticated, these trends will only continue to grow. While there is no direct relation with my technical report, my STS research deals with privacy and data through this context.

The sociotechnical portion of my thesis deals with the common practices of data collection, what they are and what they should be. The greatest challenge facing companies in this area today is their incentive structure with regards to data. Because of underlying metrics tying data to profitability, many companies just collect as much data as possible. Ultimately, they continually reference data as a commodity, a resource to be prospected and used. While there are situations where this is fine, even ethical, too many abuses occur when personal data is used. Ideally, digital citizens should have control over their sensitive data, and certain metatags should be labeled as personal property. Navigating this difference in viewpoints - data as a commodity or as property - may give us a better understanding than defining the subject as just one view absolutely.

In my technical report, I reimplemented and analyzed work by researchers at UC Berkeley, UC San Diego, and Google Research through their paper *NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis*. The work revolves around a field in computer vision called novel view synthesis. The paper provides a method to generate new views of scenes with complicated geometry and appearance. Training off images provided of the scene, it optimizes an internal representation and uses that to composite novel views. The paper qualitatively and quantitatively demonstrates improvements over prior work in neural renderings and view synthesis. My analysis identifies weaknesses and future directions for Neural Radiance Fields, such as prohibitively long training times, its fragileness with dynamic objects and a lack of learned priors baked into the model during training. My reimplementation was created with Python using the Pytorch framework.

My STS and technical research combined to illustrate how technical and non-technical approaches to problem solving have different priorities, thus yielding different results. Doing both these projects highlights how reliance on any one discipline or metric limits how you view and create solutions. By using solely technical side, a focus on metrics and performance come at the expense of human factors. An excellent example of technical success but ethical failure is *Jurassic Park*. To quote Jeff Goldblum “Your scientists were so preoccupied with whether or not they could that they didn't stop to think if they should”. By focusing only on the quantifiable aspects of the problem, their scientists failed to heed other warnings that led to the disaster depicted in the movie. For various reasons, it truly does matter how individuals in society engage with others. While ethics and morality can’t easily be quantified or reasoned about, its importance is not diminished. The admirable engineer may not be the smartest person, but the

one who can combine information from a wide variety of sources, who can clearly sort out what matters from what doesn't.