I will present two projects related to making patch-based image synthesis scalable and fast, and automatically optimizing image pipelines.

The first paper is called "PatchTable: Efficient Patch Queries for Large Datasets and Applications." It was presented at ACM SIGGRAPH 2015. This paper presents a data structure that reduces approximate nearest neighbor query times for image patches in large datasets. Our new algorithm, PatchTable, offloads as much of the computation as possible to a pre-computation stage that takes modest time, so patch queries can be as efficient as possible. The algorithm is based on a locality sensitive hashing scheme. We show experimentally that this accelerates the patch query operation by up to 9x over k-coherence, up to 12x over TreeCANN, and up to 200x over PatchMatch. Our fast algorithm allows us to explore efficient and practical imaging and computational photography applications. We show results for artistic video stylization, light field super-resolution, and multi-image inpainting.

The second paper is called "Image Perforation: Automatically Accelerating Image Pipelines by Intelligently Skipping Samples." It will be presented at SIGGRAPH 2016. It presents a new optimization technique that can be used to accelerate image pipelines by automatically trading off between performance and accuracy. Image perforation works by transforming loops over the image at each pipeline stage into coarser loops that effectively "skip" certain samples. These missing samples are reconstructed for later stages using a number of different interpolation strategies that are relatively inexpensive to perform compared to the original cost of computing the sample. For the applications we investigated, image perforation achieves speedups of 2x-10x with acceptable loss in visual quality.

About the Speaker:

Connelly Barnes is an Assistant Professor of Computer Science at the University of Virginia. His group develops techniques for efficiently manipulating visual data in computer graphics by using semantic information from computer vision. Applications are in computational photography, image editing, art, and hiding visual information. Many computer graphics algorithms are more useful if they are interactive, therefore, his group also focuses on efficiency and optimization, including some compiler technologies. He enjoys outdoor activities such as hiking and snowsking.