Volume rendering was first introduced in 1988. In the past 29 years, it has evolved from a research topic to wide spread use in applications from medicine to non-destructive testing to large-scale simulations of physical systems. In this course, we will examine how volume rendering has evolved since its introduction by reading seminal papers and discussing the advantages and disadvantages of various methods. Some have withstood the test-of-time and others have been replaced by newer methods that are more robust. Most research contributions have either improved the rendering quality or the rendering speed. In this course, you will write several volume renderers what run on GPUs and implement a project based on either your current research or an interesting research paper of your choice.

Grading will be based on:

50% project
25% assignments
25% class participation

Tentative schedule (subject to change):

Week 1: (August 22/24) intro to volume rendering
Week 2: (August 29/31) read the drebin/hanrahan paper, Levoy paper
Week 3: (Sept 5/7) transfer functions (Gordon’s paper, multi-D transfer functions)
Week 4: (Sept 12/14) Slice-based papers (SGI, GPU Gems)
   Assignment: write a slice-based renderer
Week 5: (Sept 19/21) ray-casting papers (Jens’ paper)
Week 6: (Sept 26/28) splatting methods
Week 7: (Oct 3/5) IEEE VIS
   Assignment: write a ray-casting renderer with xfer func gui
Week 8: (Oct 10/12) Fall Break
Week 9: (Oct 17/19) projected polyhedra
Week 10: (Oct 24/26) shadows with slices,
Week 11: (Oct 31/1) shadows with ray-casting (volume vs incremental)
Week 12: (Nov 7/9) pre-integration
Week 13: (Nov 14/16) non-normal illumination
Week 14: (Nov 21) Thanksgiving
Week 15: (Nov 28/30) project talks
Week 16: (Dec 5/7) no class