CMSC740
Advanced Computer Graphics

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Final project proposals

- Decide on project proposal
  - Pick from suggestions or your own project, within scope of course topics
  - Topics may involve extension of Aris renderer, improved implementation of algorithm from paper, synthesis of techniques from several papers
  - Encourage research content, novelty
- Send e-mail to instructor with your choice by Tuesday Nov. 4
  - List team members (up to two)
  - Instructor will answer questions, approve student-defined projects, etc.
- Deliverables
  - Report (4-8 pages)
  - Code
  - Result images and comparisons
- May work in groups of 2, need to specify division of work in report
- Deadline: Tuesday December 13 (reading day), 11:59pm
- Note: final exam Thursday, Dec. 18, 10:30am - 12:30pm, IRB2107

1. Advanced rendering algorithms

- For example, advanced sampling strategies, bidirectional path tracing, path guiding, improved neural radiosity, etc.

- Learn from PBRT book
  https://www.pbr-book.org/
- Goals
  - Build on existing path tracing code
  - Demonstrate capabilities, improvements vs. simple, unidirectional path tracing

2. Advanced appearance model

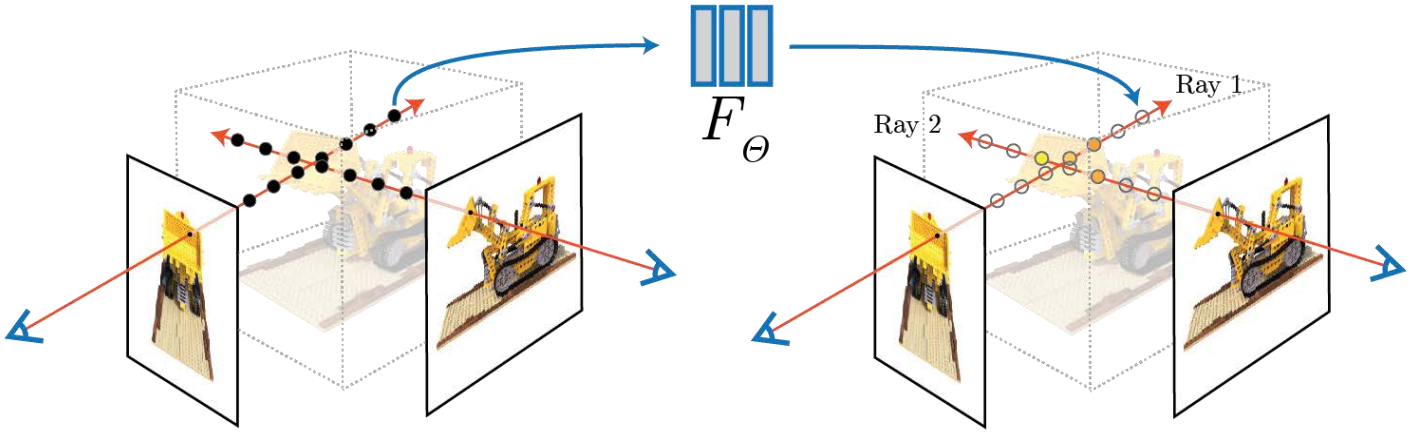
- Participating media, subsurface scattering, hair, advanced BRDF models, etc.
- Build on existing code
- Learn from PBRT book
  https://www.pbr-book.org/
- Demonstrate using a nice scene

3. Geometry processing using deep learning

- Re-implement, experiment with, improve existing methods
  - Study hyperparameters, identify disadvantages/failure cases, perform ablation studies
- E.g. surface reconstruction from point clouds
  - Start with simple approach, e.g. “Implicit Geometric Regularization for Learning Shapes” https://arxiv.org/pdf/2002.10099.pdf
    https://github.com/amosgropp/IGR

4. Inverse rendering (NeRF etc.)

- Build on existing code repos https://docs.nerf.studio/ or implement in code framework used for class
- Experiment with, improve existing methods
  - Study hyperparameters, identify disadvantages/failure cases, perform ablation studies



NeRF, https://arxiv.org/abs/2003.08934

5. Generative modeling

- E.g., diffusion models
  - Images, video, geometry

6. Your own research project

- Related to rendering, 3D geometry, image synthesis, or beyond (vision, optics)
- Get instructor’s approval

Grading

- Report (4-8 pages):
  - Description of problem that was addressed
  - If applicable: summary of own previous work on problem
  - Brief summary of related literature
  - Explanation of implemented algorithm/approach, including description of existing code that was used
  - Description of data gathered for the project (if applicable)
  - Presentation of experimental results, including (if applicable) numerical comparisons, visual comparisons, parameter studies (influence of different algorithm parameters), ablation studies (influence of different system components)
  - Conclusions
- Criteria for grading: comprehensiveness, clarity, support of textual explanations with additional data (images, numerical data, explanatory figures), technical depth, initiative to develop own improvements/extensions of existing algorithms/approaches
- Code, criteria for grading: clarity, correct functionality, technical difficulty, range ("amount") of functionality