Black-Box Analysis:

From Theory to Practice

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NYU | COURANT INSTITUTE OF MATHEMATICAL SCIENCES

Who Am I?

- Assistant Professor/PostDoc in Computer Science at New York University

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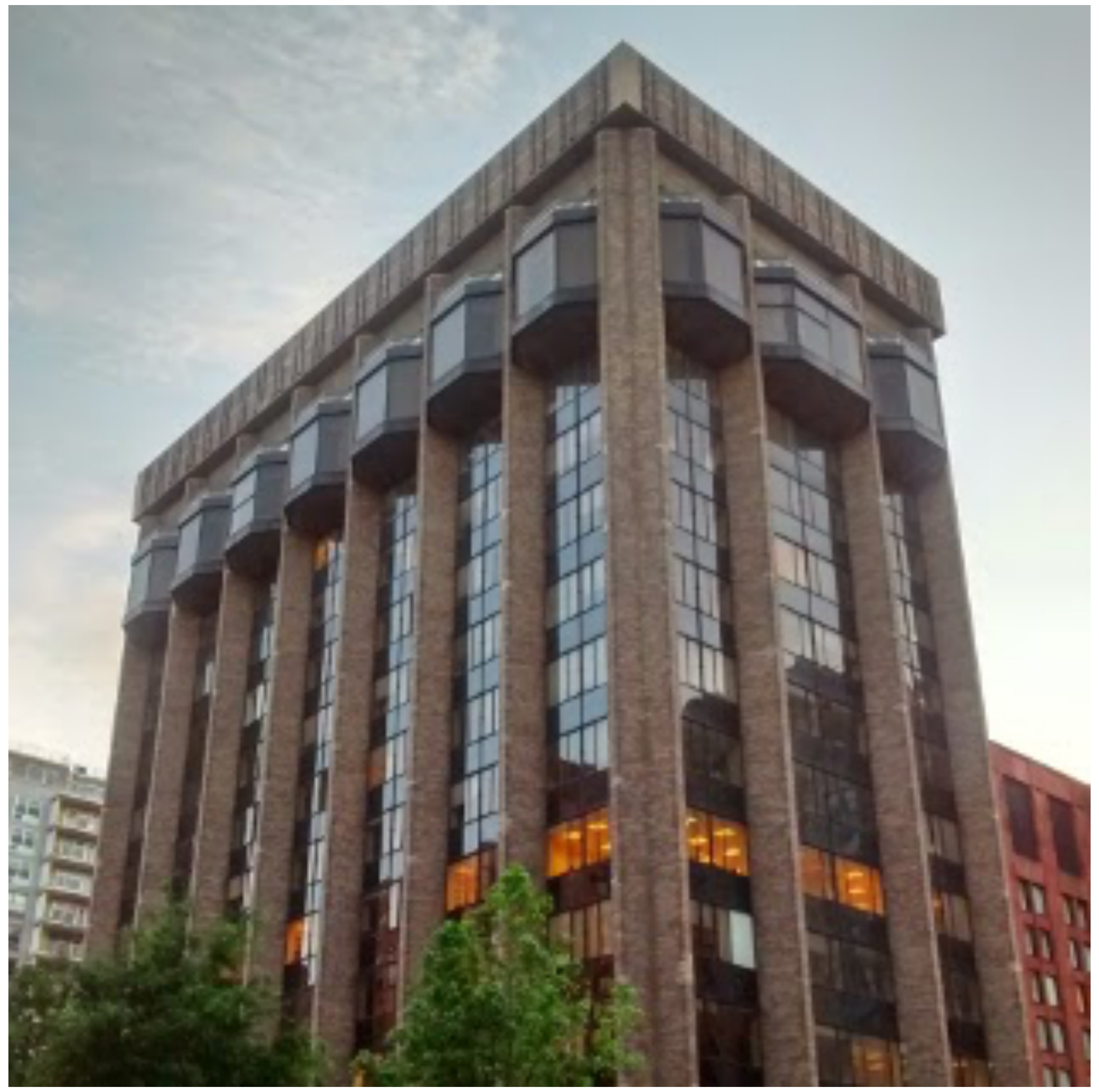
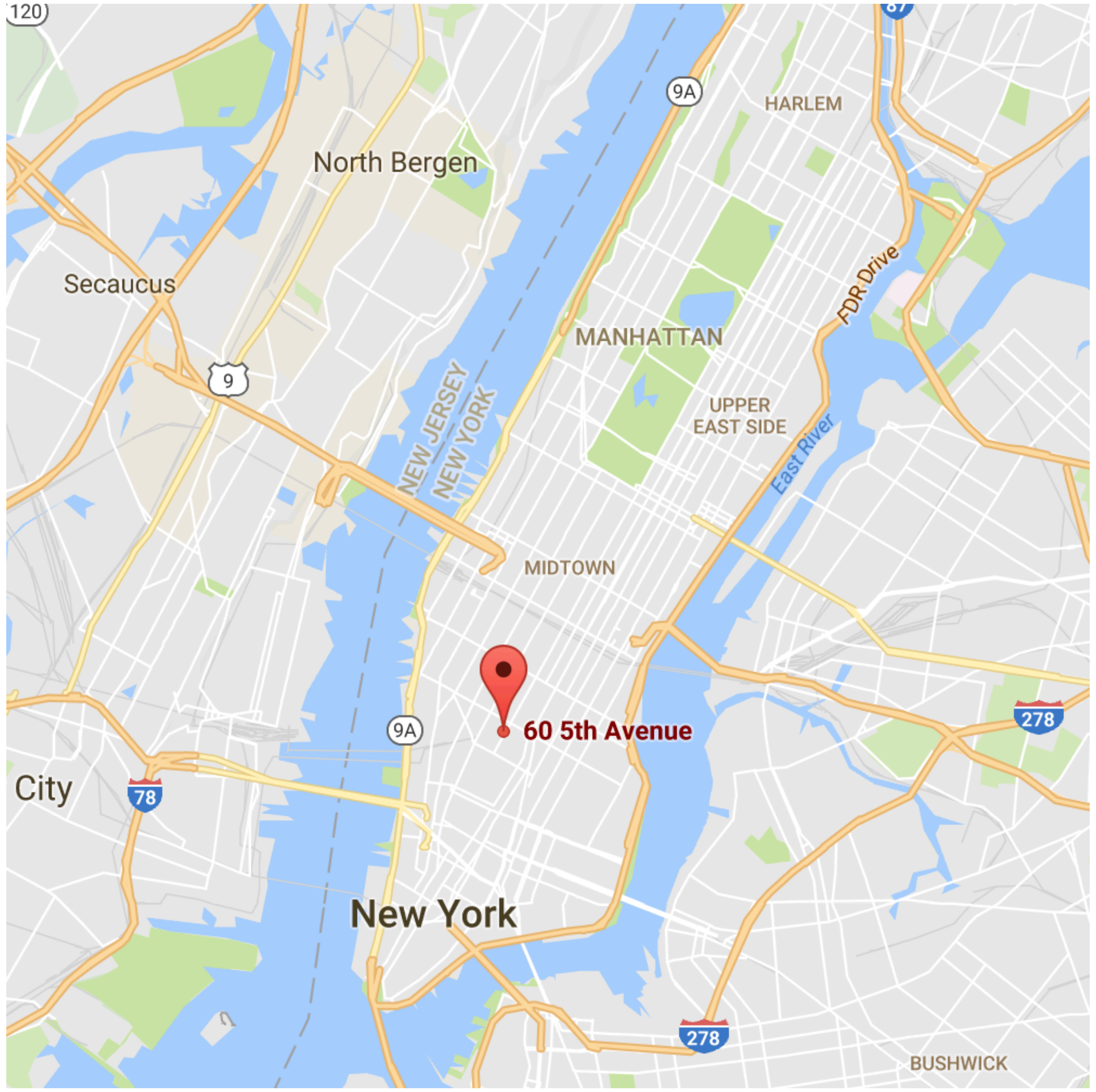




Geometric Computing Lab @ NYU

Faculty

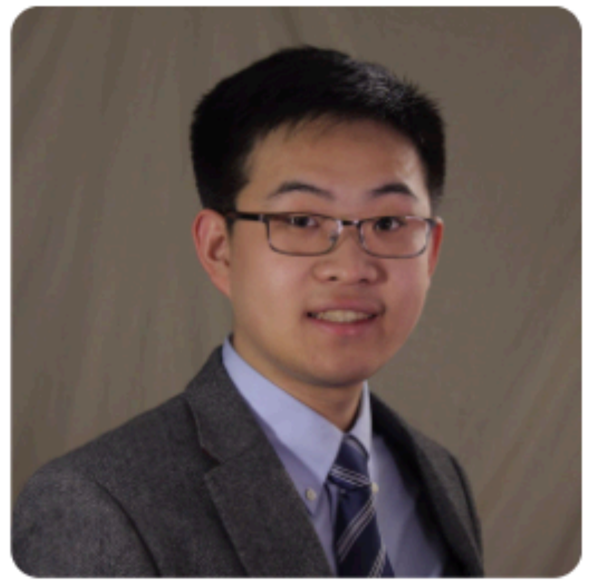

Daniele Panozzo


Denis Zorin

Postdoctoral Researchers


Teseo Schneider

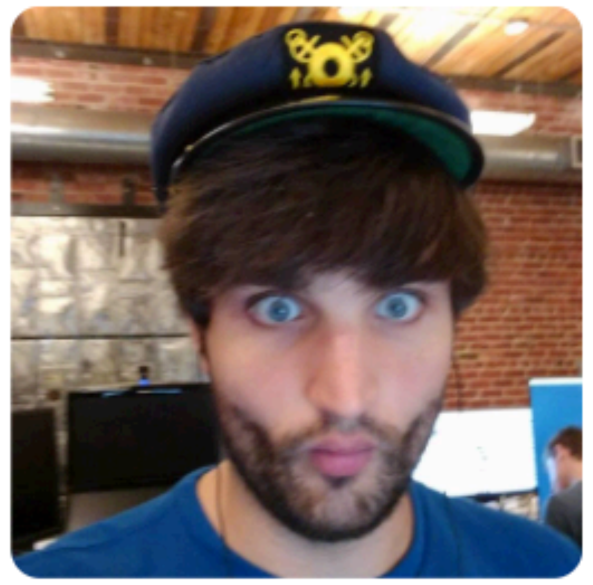
PhD Students

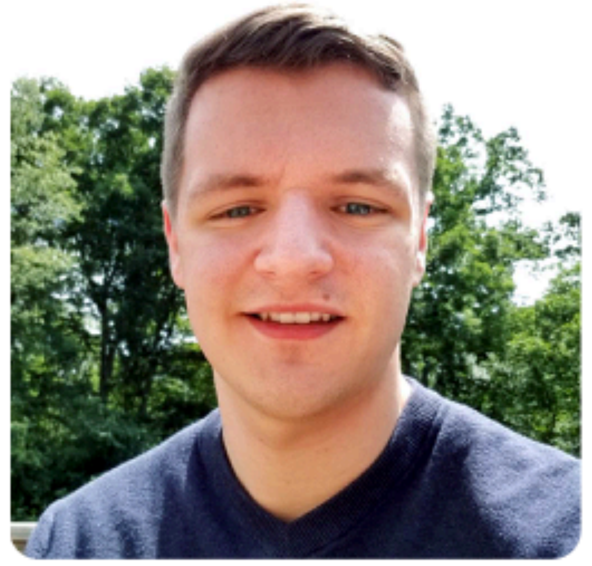

Zhongshi Jiang


Yixin Hu


Hanxiao Shen


Matt Morse


Francis Williams


Zachary Ferguson


Davi Colli Tozoni


Leyi Zhu


Siqi Wang

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Course Goals

- Learn the basics of the finite element method (FEM)
- Understand the state-of-the-art in meshing and FEM
- Learn how to design, program, and analyze algorithms for **geometric computing**
- Hands-on experience with shape modeling and geometry processing algorithms
- Learn how to batch process large collections of geometric data and integrate it in deep learning pipelines

Geometric Computing

Big Data

Discrete Differential Geometry

- Surface and volumes representation
- Differential properties and operators

High Performance Computing

- Vectorized computation
- Multi-core and distributed computation
- GPU accelerators

Geometric Computing

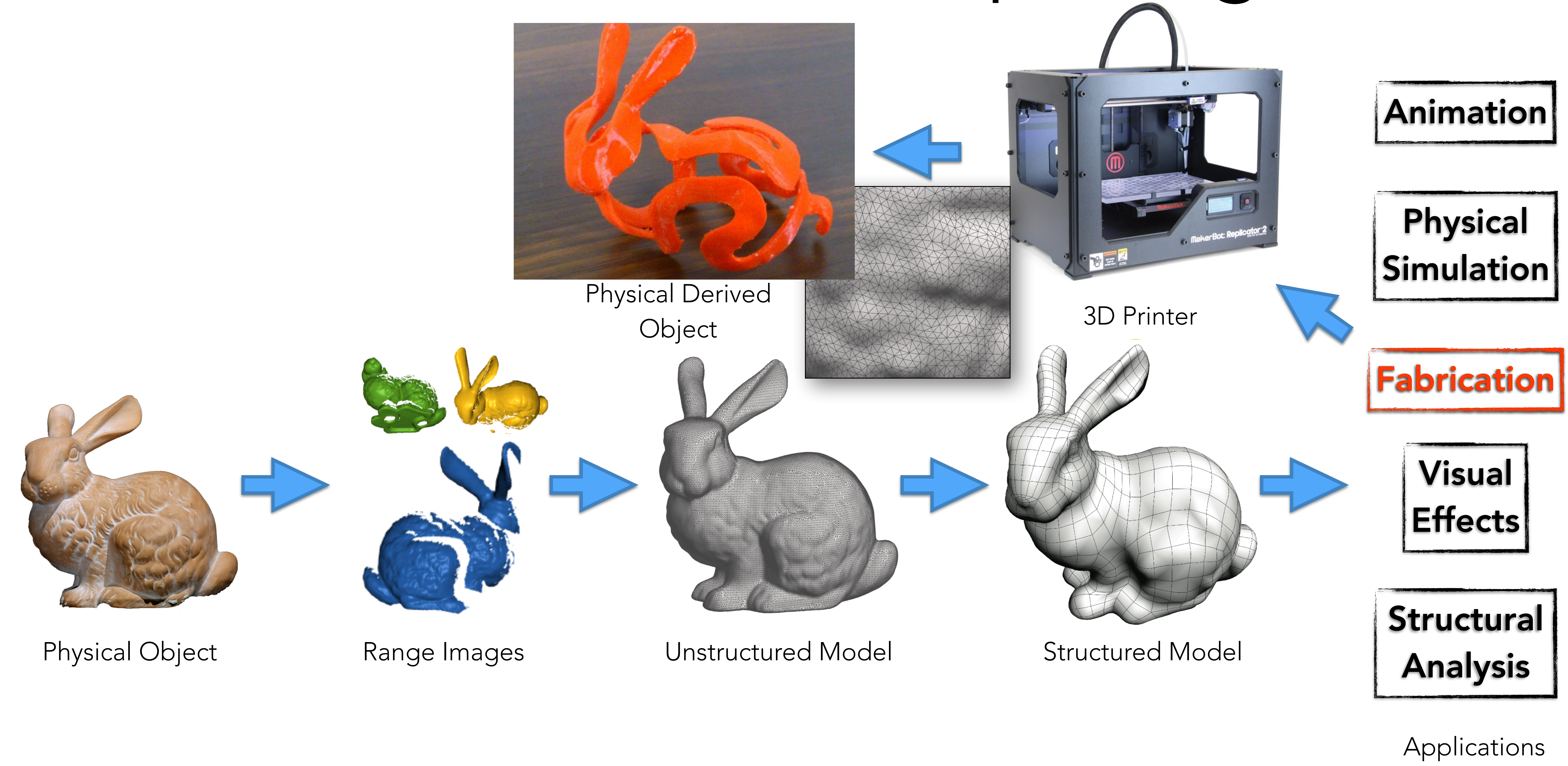
Numerical Method for PDEs

- Focus on real-time approximations
- Irregular domains

Human Computer Interaction

- Objective evaluation of the results
- Architects and artists benefits from our research

Geometric Computing



Course Overview

- **Introduction to FEM**
- **Black-Box Analysis: Theory**
- **Black-Box Analysis: Practice**
- Q&A

Getting Started

- The course relies on Conda

  a cross-platform package and environment management system

- Add conda-forge channel

```
conda config --add channels conda-forge
```

- Create an environment

```
conda create -n course
```

- Activate an environment

```
conda activate course
```

Libraries Overview

Cross Platform: Windows, MacOSX, Linux

Basics

- Numpy, basic linear algebra

  `conda install numpy`

- Scipy, advanced sparse algebra

  `conda install scipy`

- Plotly, basic plotting

  `conda install plotly`

- Quadpy, quadrature

  `pip install quadpy`

Jupyter

- The all examples uses Jupyter Notebooks
  a web application that allows you to create and share documents that contain live python code

- Install Jupyter

```
conda install jupyter
```

- Run Jupyter

```
jupyter notebook
```

Jupyter Demo!

https://github.com/teseoch/fem-intro