# Computer Graphics

# 1 - Course Intro

Yoonsang Lee
Spring 2019

# Course Information

- Instructor: Yoonsang Lee (이윤상)
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- Course Hompage
  - The lecture home at learn.hanyang.ac.kr
  - Slides will be uploaded to **Course Content(코스 콘텐츠)** – **Lecture Slides** as soon as it is ready, but they may be updated until just before the lecture.

# What is Computer Graphics?

- The study of creating, manipulating, and using visual images in the computer.



Modelling → Simulation & Rendering → Image

Animation (a series of images)
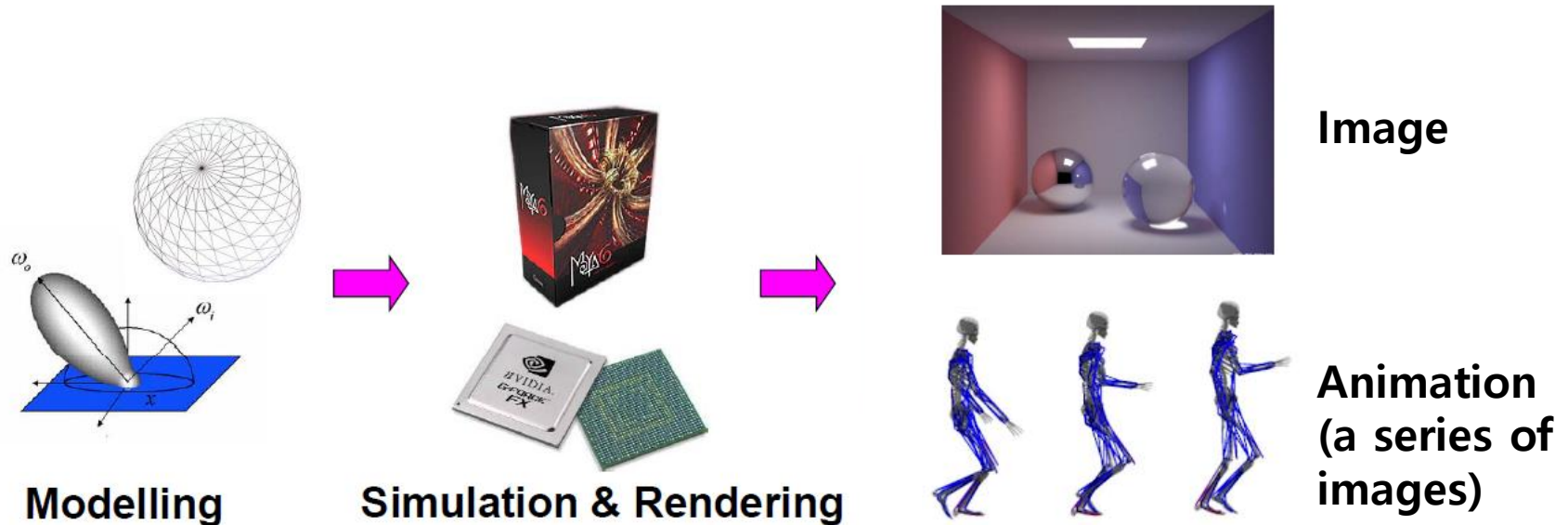
Computer vision inverts the process
Image processing deals with images
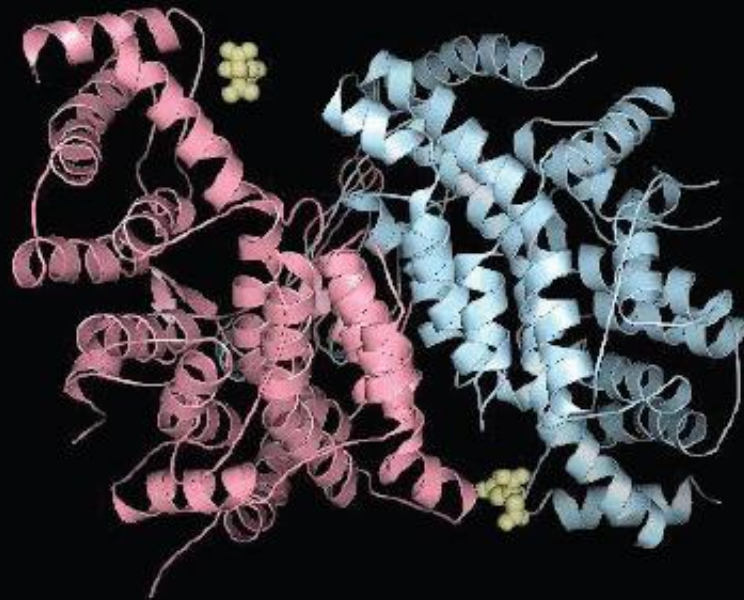
# Movies & Games



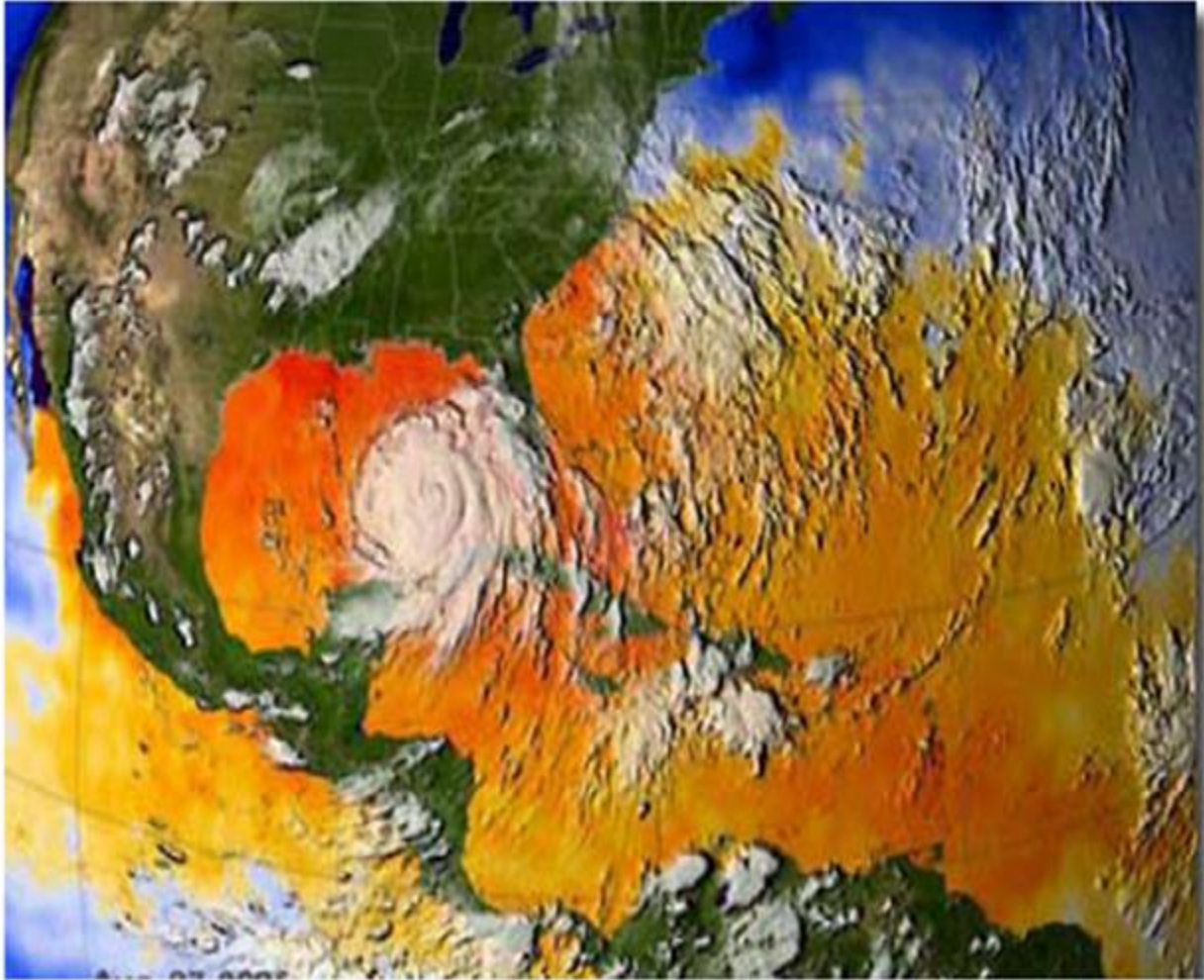Star Wars: The Last Jedi

Assassin's Creed Odyssey

# Science and Engineering



Simulated deformation of citrate synthase during substrate binding

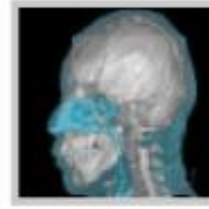Kalju Kahn, UCSB

# Weather Visualization



LLNL

# Computer-Aided Design
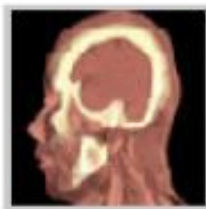
# Medical Applications
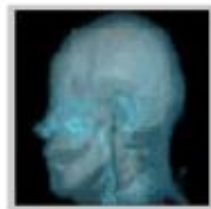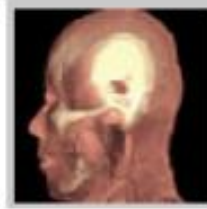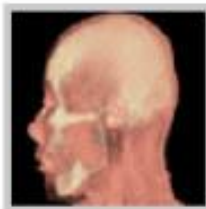


Rapidia homepage

# Fine Arts

# Course Overview

- Computer Graphics: Mathematics made visible

- In this course, you will
  - Explore fundamental computer graphics & mathematics ideas
  - Write cool programs (using Python and legacy OpenGL)

- You will not
  - Learn sophisticated computer graphics techniques
  - Learn about modern OpenGL APIs
  - Write big programs

# Course Overview

- As "implementation examples" of fundamental computer graphics ideas, we'll use:

- Legacy OpenGL (mainly)

- On-line WebGL demos (sometimes)

- Blender: open-source 3D graphics tool (sometimes)

# Prerequisites

- Basic knowledge of mathematics
  - E.g., vector geometry, linear algebra

- Basic knowledge of programming skill
  - We'll use Python in this class.

- You don't need artistic sense!

- If you are unsure, consult the instructor at the end of this class.

# Textbook & References

- **Textbook : Lecture slides**

- References
  - Fundamentals of Computer Graphics
    - 1,2 or $3^{rd}$ edition
    - Peter Shirley et al.
    - AK Peters
  - OpenGL Programming Guide
    - Version 1.1 is available at internet
    - http://www.glprogramming.com/red/
    - Reference book is also available
    - http://www.glprogramming.com/blue
  - (I don't think you need to buy these books)
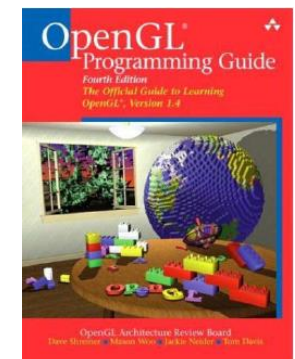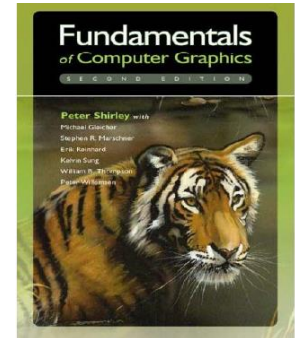
# Schedule (subject to change)

| Week | Topic | Mon | Wed |
|---|---|---|---|
| 1 | 1 - Course Intro / Lab1 - Environment Setting | 3/4 | 3/6 |
| 2 | 2 - Introduction to NumPy / OpenGL | 3/11 | 3/13 |
| 3 | 3 - Transformation 1 | 3/18 | 3/20 |
| 4 | 4 - Transformation 2 | 3/25 | 3/27 |
| 5 | 5 - Rendering Pipeline | 4/1 | 4/3 |
| 6 | 6 - Hierarchical Modeling & Mesh | 4/8 | 4/10 |
| 7 | 7 - Lighting & Shading | 4/15 | 4/17 |
| 8 | Midterm Exam | 4/22 | 4/24 |
| 9 | 8 - Orientation & Rotation | 4/29 | 5/1 |
| 10 | 9 - Animation | 5/6 | 5/8 |
| 11 | 9 - Animation | 5/13 | 5/15 |
| 12 | 10 - Curve | 5/20 | 5/22 |
| 13 | More Lighting / Texture | 5/27 | 5/29 |
| 14 | Rasterization & Visibility / Ray Tracing | 6/3 | 6/5 |
| 15 | Additional Topics | 6/10 | 6/12 |
| 16 | Final Exam | 6/17 | 6/19 |

# Lectures & Labs

- Lecture (Mon) + Lab (Wed)

- Lecture (by instructor)
  - Traditional classroom-based learning.

- Lab (by TA)
  - Time for solving lab assignment problems by yourselves.
  - TA and an undergraduate mentor will help you.

# Lab assignments

- 1 lab assignment per each lab session.
  - with 2~3 problems

- The goal is to let you understand what you've just learned in lectures every week.
  - The problems would not be too difficult.
  - TA and the undergraduate mentor will help you to solve the problems as much as possible.

- Recommended due: The end of the lab session.
- Hard due: 23:59 on the day.

# Class assignments

- 3 class assignments during the semester.

- More challenging programming assignments.

- The due date will be two to three weeks after the assignment is given.

# Policy for Assignments

- **NO SCORE** for late submissions
  - Submit before the deadline!

- **NO SCORE** for copying
  - If A copies B's code, A and B will get 0 point.
  - If A, B, C copies the same code from the internet, they will all get 0 point.
  - Collaboration encouraged, **but assignments must be your own work.**

# About Laptop

- Lecture
  - The lecture slides contains many Python code.
  - I'd like you to run & test the code during a lecture.
  - So, I recommend you to bring your laptop at lecture time.

- Lab
  - The lab is held in a laptop-only training room.
  - If you want to borrow a laptop, contact the TA by email until the lab in this week.
  - But, I strongly recommend you to bring your laptop at lab sessions.

# Grading

| Midterm exam | 30% |
|---|---|
| Final exam | 30% |
| Lab assignments | 15% |
| Class assignments | 15% |
| Attendance | 5% |
| Class attitude | 5% |

- To avoid F, you have to attend at least **9 lectures && 9 labs**
- Absences from midterm or final exam -> F

# Grading Policy

- Basic principle: Separating the grades where there is a big gap between points.

- Guideline:

| A | 25%~30% |
|---|---------|
| B | 30%~35% |
| C | 40% |

# Language

- I will mainly use English in classes.

- But **the most important goal is improving your understanding**, both for English and non-English speakers.
  - So, I'll **"paraphrase" the explanation in Korean for most slides.**

- In lab sessions, TA will try to use English.
  - You can ask TA personally in Korean.
  - Of course, TA will try to give answers in English when asked in English.

- Now, let's have a brief summary for prev. slides in Korean.

# Questions – Slido.com

- I know very well how uncomfortable it is to ask questions in the middle of class.

- Now you can feel more comfortable asking questions, because we'll use an online, anonymous Q&A platform – slido.com

# Just Try It!

- Go to https://www.slido.com/

- Join #cg-hyu


- Ask any questions **in English!**
  - You can use Google Translator if you have difficulty writing in English.

# Questions – Slido.com

- In slido.com, you can
  - **Ask** your own questions
  - **Upvote** other questions


- We'll use the slido Q&A **only during class time.**
  - Not after class time
  - Not in the lab sessions
  - No written answers


- Please ask questions **anonymously**.
  - Just leave your name blank when post a question.

# Quiz & Attendance – Slido.com

- 3 quiz problems per each lecture (using slido.com poll).

- Very simple questions – you have to submit in two minutes.

- I'll check attendance using quiz submission.

# Quiz & Attendance – Slido.com

- You **MUST** submit your answer in the following format:
  - **Student ID: Your answer**
  - **e.g. 2017123456: 4)**

- Attendance checking:

| Attendance | Number of submissions in the format - **3 times** **&&** You are **in the classroom** |
|---|---|
| **Late** | Number of submissions in the format – **1~2 times** **&&** You are **in the classroom** |
| **Absence** | Number of submissions in the format – **0 times** **||** You are **NOT in the classroom** |

  - **3 lates are regarded as 1 absence.**

# Quiz & Attendance – Slido.com

- If submitting a quiz answer without attending the class is detected,

- I think he or she has been absent from all lectures from the date of the last attendance call.

- -> Check as "Absence" for all those lectures

# Just Try a Quiz!

- Go to https://www.slido.com/
- Join #cg-hyu
- Click "Poll"

- Submit your answer in the following format:
  - **Student ID: Your answer**
  - **e.g. 2017123456: 4)**

- Note that you must submit all quiz answers in the above format to be checked as "attendance".

# Classroom Etiquette

- **DO NOT negatively affect other students** in the classroom. For example,
  - Doing other things (e.g. games) with your laptop
  - Using your phone for a long time
  - Private conversation
  - Sleeping on a desk

- May be reflected in "Class attitude" in your grade

# My Recommendation for This Class

- DO NOT recommend to those who...
  - want to easily earn good credits.
  - expect lectures in fluent English.

- Recommend to those who...
  - wonder how movies/games render scenes.
  - interested in the movement of objects/characters.
  - like visualizing something by coding.
  - have passion for computer graphics!

# Lastly...

- If you agree on all these policies, see you this week's lab session!

- If not, please consider taking other classes instead.

# Next Time

- Lab in this week:
  - 1-Lab-EnvSetting: Environment settings for lectures & assignments
  - Lab assignment 1

- Next lecture:
  - 2 - Introduction to NumPy / OpenGL

- Acknowledgement: Some materials come from the lecture slides of
  - Prof. Taesoo Kwon, Hanyang Univ., http://calab.hanyang.ac.kr/cgi-bin/cg.cgi
  - Prof. Steve Marschner, Cornell Univ., http://www.cs.cornell.edu/courses/cs4620/2014fa/index.shtml