Introduction to Computer Graphics

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What's it about?

- Create 3D - scenes
- Simulate how objects move
- Mathematical background

Programming environment: Webbrowser

- Platform independent, websites easy to distribute
- Modern browser are general, highly optimized computing platforms: audio/video, parallel computing, 3D graphics (WebGL), etc.
- Drawback / Opportunity: new language *Javascript*
- Alternatives: OpenGL, DirectX, Java3D

Javascript

- Javascript is *the* language of the internet
  - HMTL + CSS + Javascript: Very popular framework
  - It used to be an easy little language
  - A lot of development recently
- Similar to languages you know:
  - syntax like C
  - dynamic typing like in Matlab
  - object oriented like Java
- New features
  - functional programming
  - prototype - based object orientation
- Runs on
  - all web browsers
  - standalone, e.g. node.js
  - (Microcontrollers: Espruino, Tessel)

Working environment

Ideally: work on your own laptop

Required software:

- A WebGL-capable browser, e.g.
  - *Firefox*
  - *Chrome*
- An editor of your choice
  - Most popular: *Visual Studio Code*
    (Freely-licensed version: VSCodium)
  - Old school but powerful: *Emacs*, *Vim*
  - Many more: *Notepad++*, *Komodo Edit*, *Atom*, *Brackets*, *Eclipse*, *Netbeans*, *Aptana Studio*, etc.
- Useful tools:
  - *node.js* (Javascript engine)
  - *eslint* (Syntax checker)
  - *git* (Source code management)
  - *Python* (for running a web server)

More details on course contents

1. Introduction
2. Review of vectors and matrices
3. Introduction to Javascript
4. Getting started with WebGL and three.js
5. Geometries and coordinate systems
6. Moving things around
7. Linear maps and transformation matrices
8. Affine maps and homogeneous coordinates
9. Camera models and the view pipeline
10. Light and material
11. Shading and the fragment pipeline
12. Textures

Organization

- EMIL-Key: *CG_WS2023_JNM*
- Lecture material: `https://github.com/kjuen/CG23`
- 12 chapters, 10 lecture sessions (roughly one chaper each week)
  - Problem sheets for mathematical parts
- 4 graded programming assignments throughout the course
- Lecture format:
  - Ordinary lectures, room needs to be discussed
    - Lecture material also available in video format.
  - Labs: no groups, work on your own at home
    - No mandatory presence at HAW
    - Teams session to provide support

Examination scheme: Portfolio

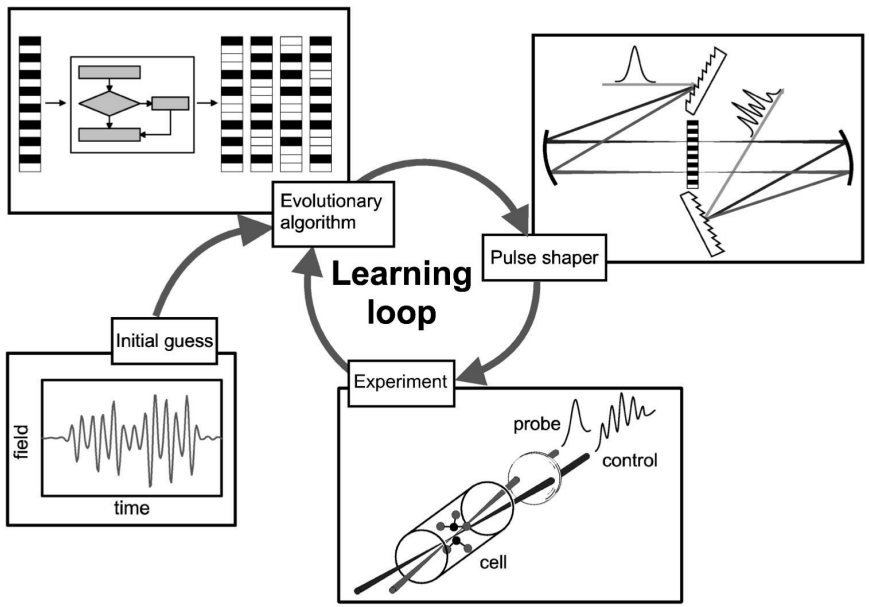
- Written exam at end of semester: 50% of overall grade
- All assignments are *graded*: 50% of overall grade
  - assignment 1: 5%
  - assignment 2: 10%
  - assignment 3: 20%
  - assignment 4: 15%
- Pre-examination credit: pass first 3 assignments with at least 5 points
- You have to write the code on your own!
- If you drop out of the course after lab 1 it is a failed attempt!

Schedule of the lecture

week	lecture no	Content
41	1	Intro and Chapter 2
42	2	Chapter 3
43	3	Chapter 4 and 5 (part 1)
45	4	Chapter 5 (part 2) and 6
46	–	Lab 1
47	5	Chapter 7
48	6	Chapter 8
49	–	Lab 2
50	7	Chapter 9
51	8	Chapter 10, Lab 3
54	9	Chapter 11
55	10	Chapter 12
56	–	Lab 4 and exam preparation

Looking for a Bachelor Thesis?

- Topic: Machine Learning with Deep Neural Networks
- Application Domain: Femtosecond Laser Physics
  - Cooperation with research group at DESY:
    `https://www.kai-hamburg.org`



- Prerequisites:
  - no prior knowledge in machine learning required
  - a bit of 'Signals and Systems' knowledge is useful