Course overview

Digital Visual Effects

Yung-Yu Chuang

Logistics

- **Instructor:** Yung-Yu Chuang (cyy@csie.ntu.edu.tw)
- **Textbook:** Readings from books, journals and proceedings. Richard Szeliski's Computer Vision: Algorithms and Applications. Richard Radke's Computer Vision for Visual Effects.
- **Webpage**: http://www.csie.ntu.edu.tw/~cyy/vfx

This course is NOT about …

It isn't about photography

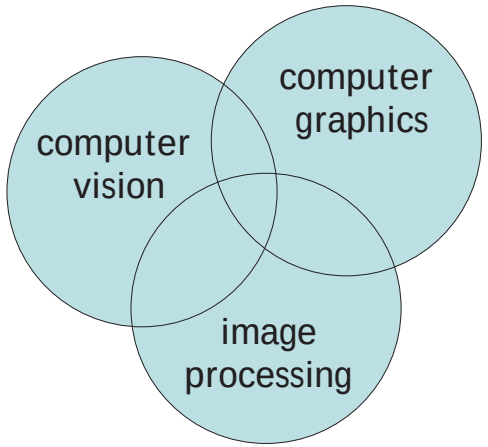
It isn't about 3D animations

It isn't about watching movies

It isn't about physical effects

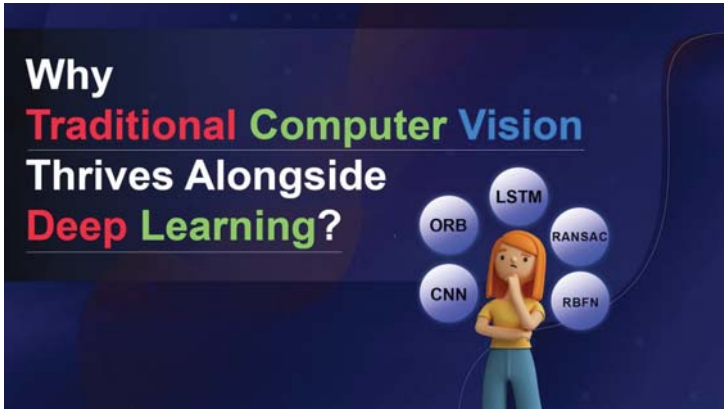
It's not about industrial tricks

You will learn more about Taylor and Poisson than Lucas and Spielberg in this course. If you hear Lucas in the class, it is more likely to refer to Bruce Lucas, not George Lucas.



It's not about deep learning

- Although some of the discussed problems have better deep learning solutions, we mostly cover the classical approaches.



Prerequisites

- It is a ***must*** that you have programming experiences.
- It is a ***must*** that you have basic knowledge on linear algebra and probability.
- It is a *plus* if you have background knowledge on computer vision, image processing and computer graphics.
- It is a *plus* if you have access to digital cameras and camcorders.

The vfx course


what other professors think you do


what other students think you do


what you thought you will do

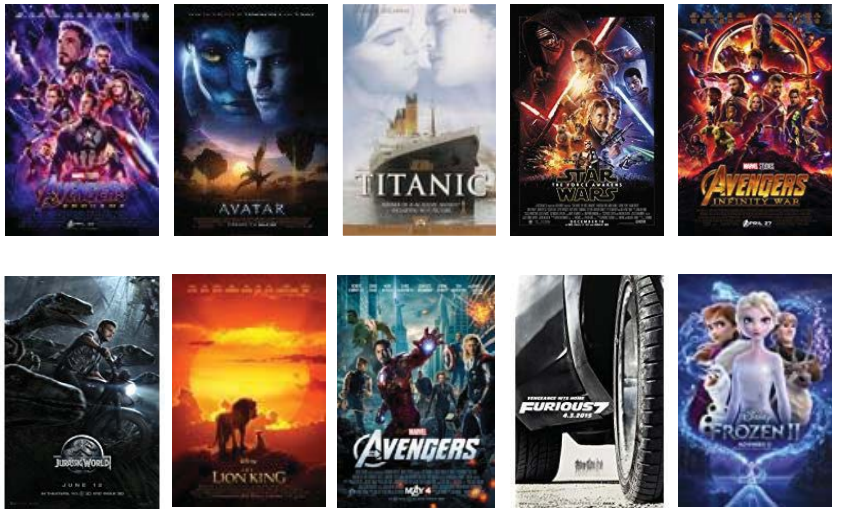
what you actually do

Be cautious!

This course is about …

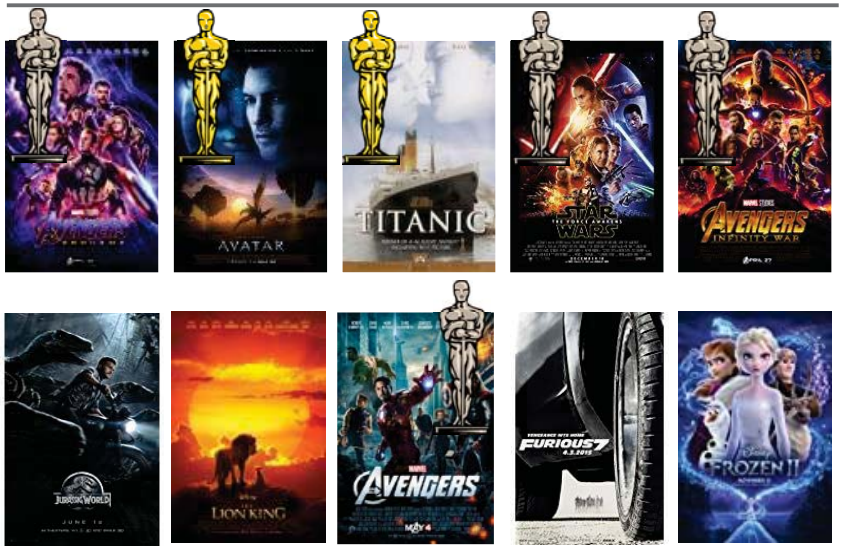
Digital Visual Effects

DigiVFX



Digital Visual Effects

DigiVFX



Deadpool

DigiVFX

Deadpool

Life of Pi

Life of Pi

獨自一人拍和十三人的戲

要把身材高大的甘道夫和小矮人們拍攝在一起，我們是沒法在同一個片場的。和我一起拍攝的只有柱子上貼著的13張他們的照片，後面還有一個小燈，哪個角色說話了燈就亮起來。想像一下你在拍一場和13個人一起演的戲，但你卻只有獨自一人。這真的會把你的演技推到極限。我哭了，真的，我當時真的哭了。然後我還說出了聲：我認真演了一輩子不是為了跟這些照片對戲啊！

VFX of the Hobbit

Reality?

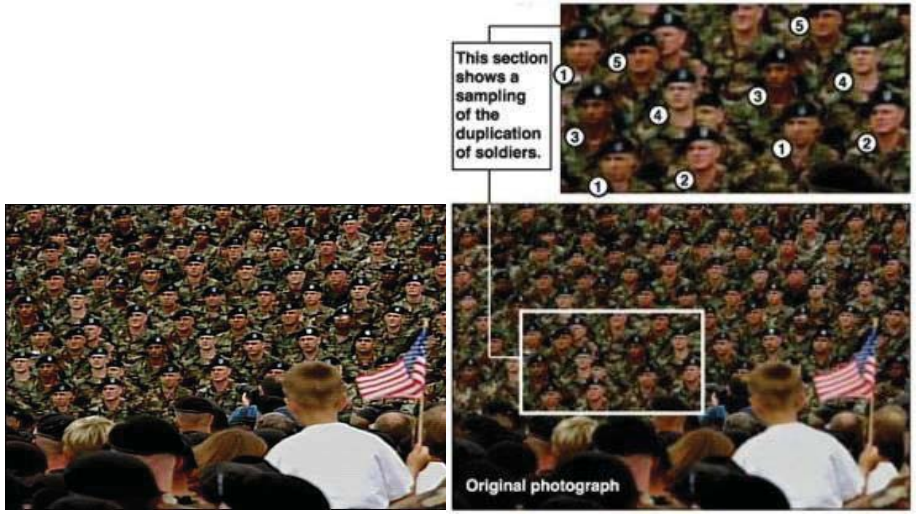
Retouching

Retouching

Retouching

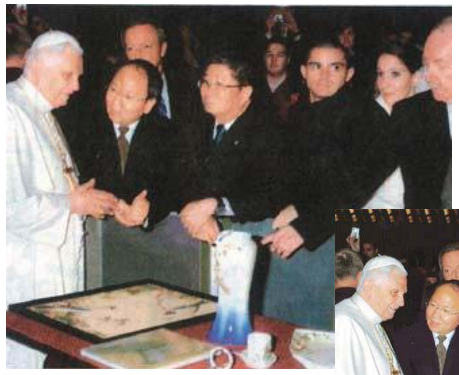
Bush campaign's TV AD, 2004

Texture synthesis and inpainting

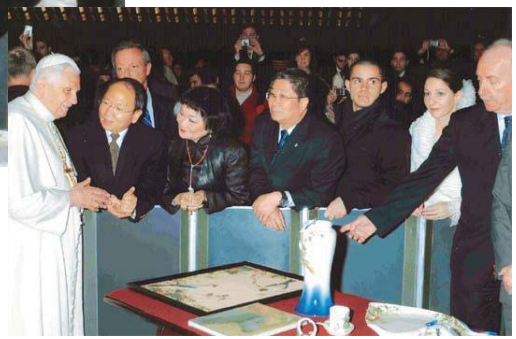


Iraq War, LA Times, April 2003

Domestic example



The Liberty Times
2007.12.17

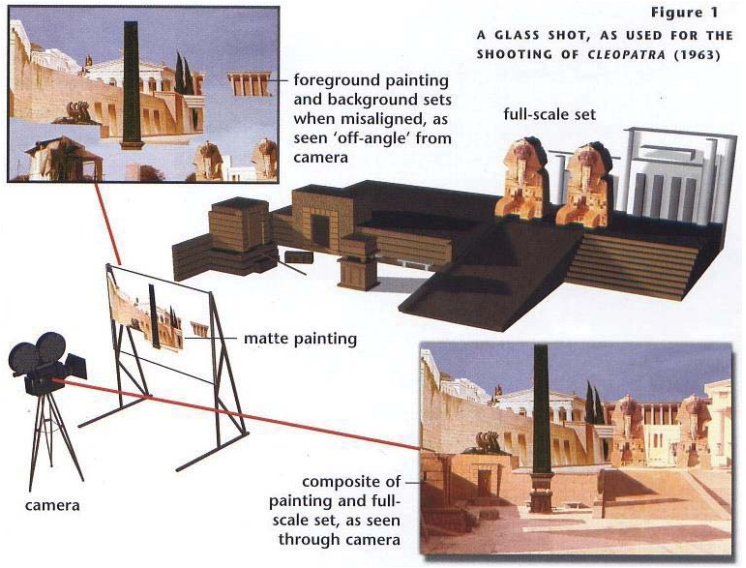


Special effects

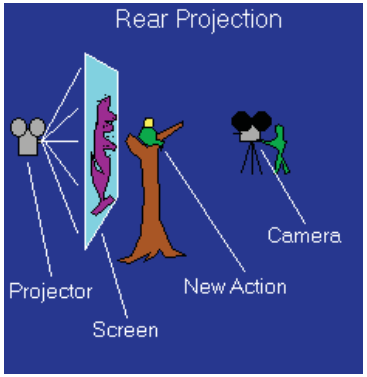
Stop action

The execution of Mary, 1895

Glass shot



Rear projection

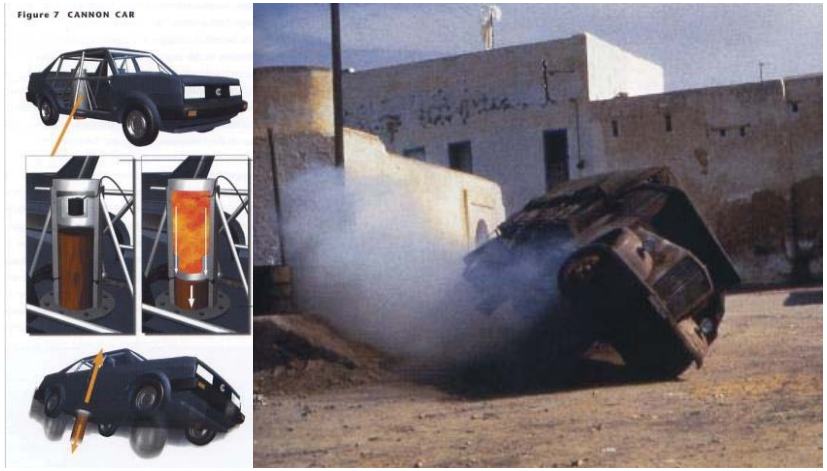


stop motion

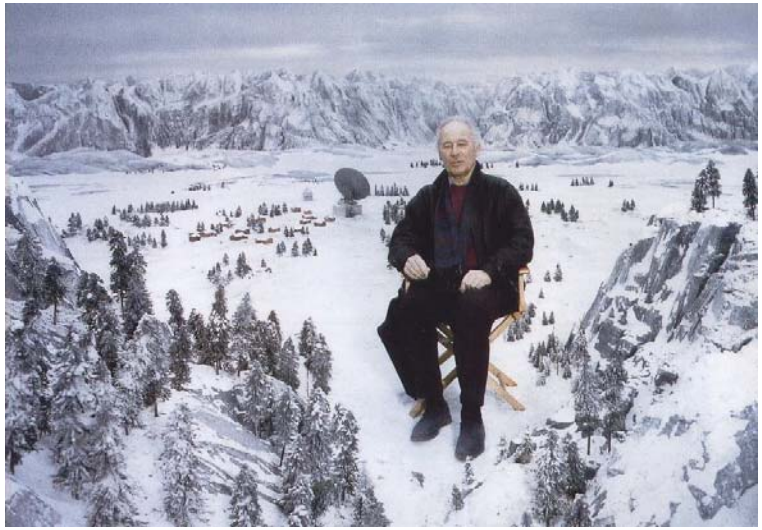
King Kong, 1933

Special effects (make-up)

Special effects (physical effects)



Special effects (miniature)



Special effects (matte painting)

Lord of the Rings

Illusion - forced perspective

Computer-generated model

The Avengers

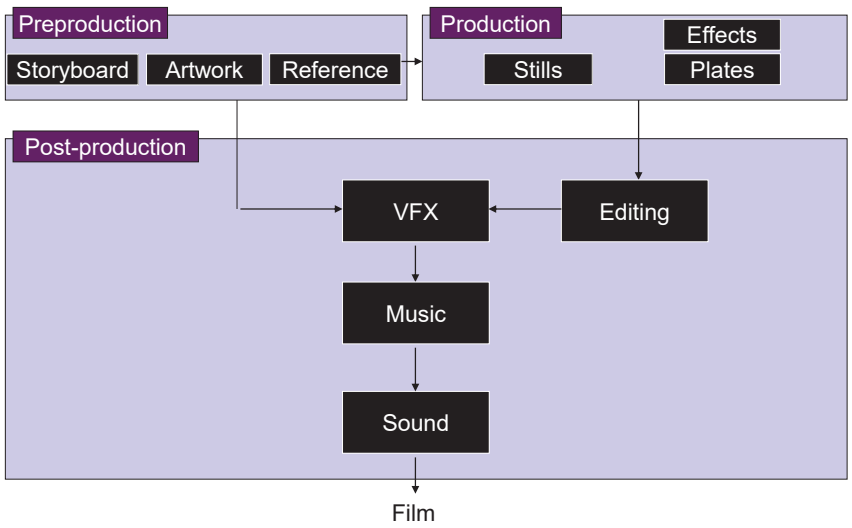
The Avengers (1978)

The Avengers (2012)

Visual effects 100 Years

Production pipeline

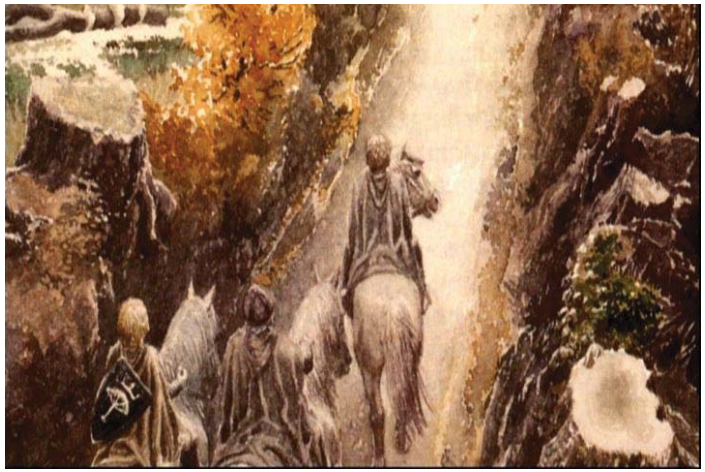
Production pipeline



Preproduction

Storyboard

Preproduction



Artwork

Preproduction

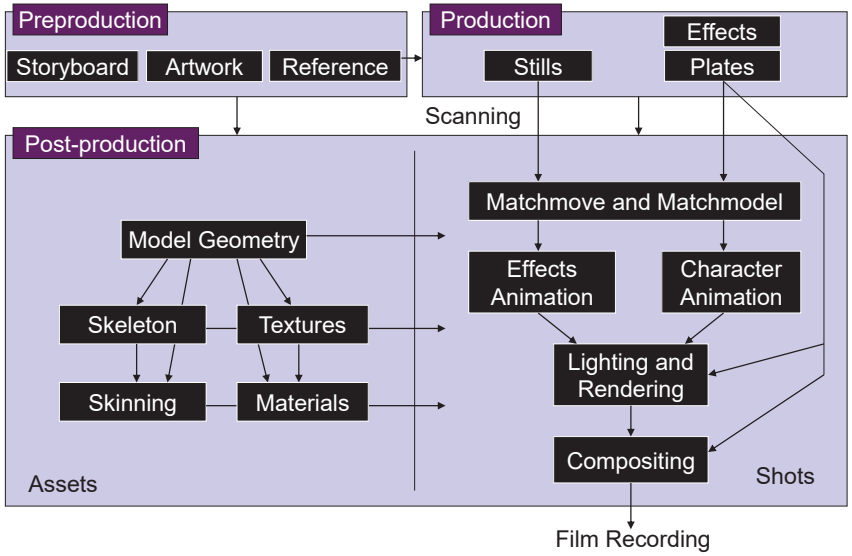
Reference & Research

Production

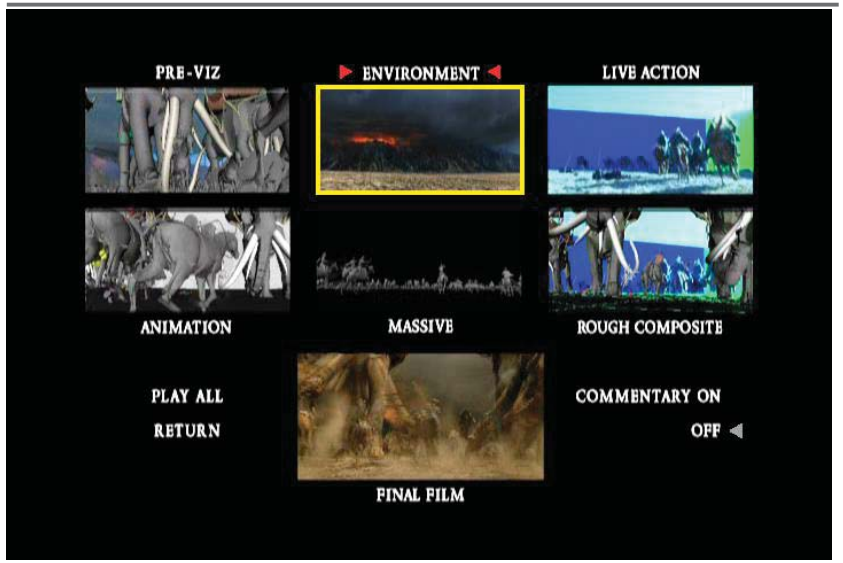
Shooting

Post-production

Visual effects production



Visual effects post-production



A case study

405: The Movie

- This movie were created solely by two visual effects artists in the year of 2000. It was a process that took over three months of nights, weekends and any spare moments that they could find.
- https://en.wikipedia.org/wiki/405_(film)
- An early example of digital filmmaking and the use of Internet as media
- Budget: $300 ($140 for tickets. The officer is acknowledged)

405: The Movie

Making of 405

Step 0: script and shooting plan

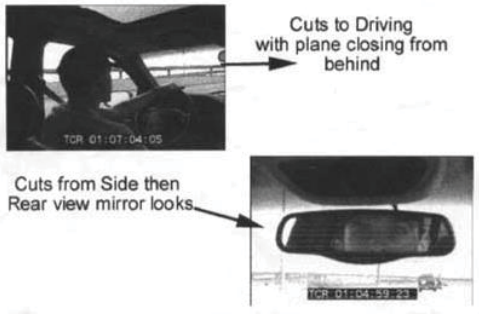
Shot#	Description	Full CG	CG	Length Frames
01	Title Animation	X	X	401
02	Freeway speeds beneath car			123
03	Speed Limit 65			120
04	LA Freeway from Overpass			238
05	Empty Freeway--Car enters frame	X	X	150
06	Pan From Freeway J looks at lack of traffic			237
07	Plane swings into landing position toward freeway	X	X	139
08	Hand on Gear shift			36
09	Plane lowers into view through rear window		X	84
10	Plane nears Car	X	X	65
11	J looks to side mirror--plane visible behind		X	84
12	Plane in sideview mirror		X	65
13	J looks from side view to rear view mirror -- plane behind		X	27
14	J eyes react in rear view mirror--remove traffic		X	33
15	Plane chases Car toward camera	X	X	77

Making of 405

Step 1: shooting

two days with a Canon Optura DV camera with progressive mode.
⇨ a 70-minute raw footage

initial editing
⇨ pickup shots



Making of 405

Step 2: building CG world

total 62 shots, 42 enhanced with digital VFX.
19 shots are entirely digital creations.
plane, two cars, freeway background are digital

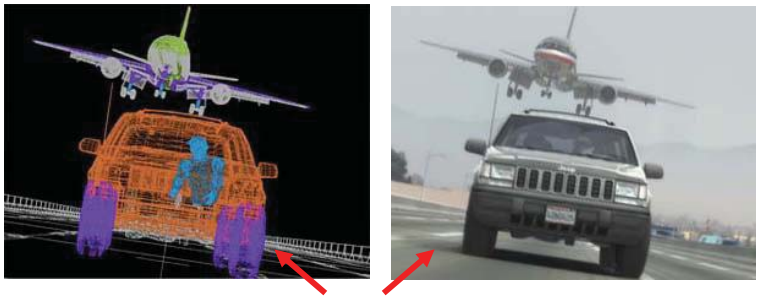


photo-based 3D environment

Making of 405

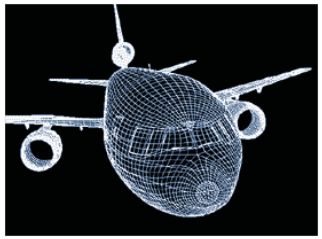
Real cars were used for close-up and interior shots

A low-resolution mesh scanned by a cyberscanner.
Mapped with photographs.

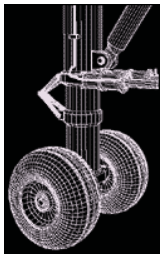
Making of 405

DC-10 plane took a month to model in details for the needs of close-up shots.

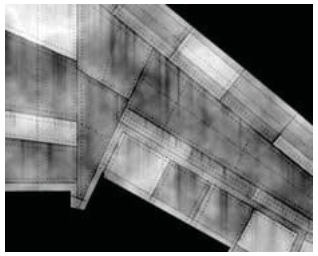
59 objects, 142,439 polygons



reference



modeling



material painting

Making of 405

Step 3: traffic clearing

clean plate

close-up shots

inpainting

Making of 405

Step 4: compositing

shot with the vehicle standing still in a backyard

Making of 405

Making of 405

DigiVFX

Step 5: fine touchup

3D hat

compositing and inpainting

Making of 405

DigiVFX

Step 6: music and delivery

Bloody Omaha

DigiVFX

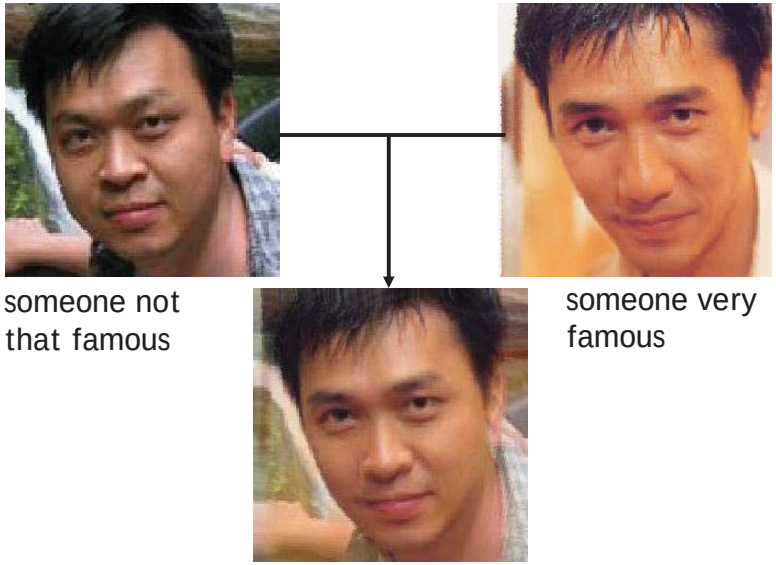
Topics we plan to cover

Camera

Canon 10D

High dynamic range imaging/display

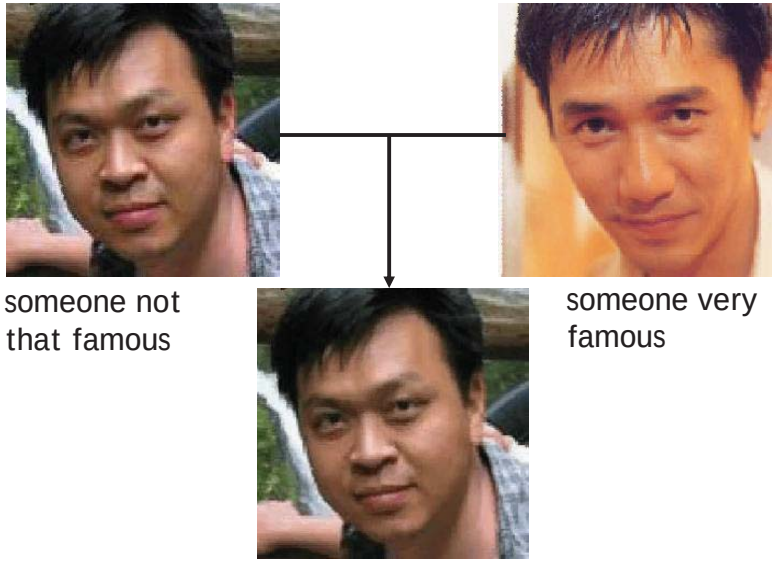
Image warping/morphing



someone not that famous

someone very famous

Image warping/morphing

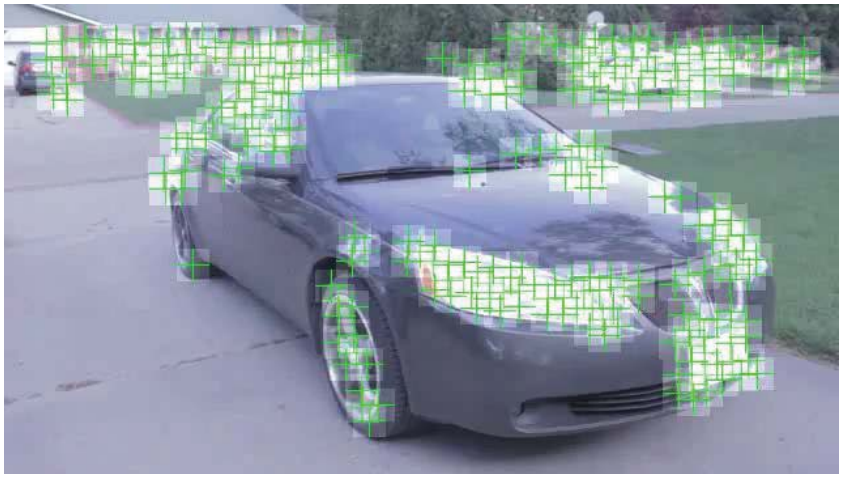


someone not that famous

someone very famous

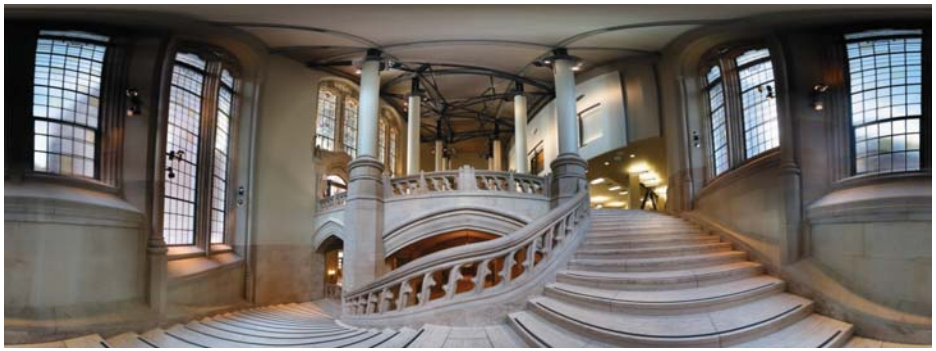
Image warping/morphing

Tracking



Feature tracking

Image stitching



MatchMove

Move matching using scene planes

Matchmove

Move matching using scene planes

Matchmove

Move matching using scene planes

Photo tourism

Video matching

Matrix *MOCO (Motion control camera)*

Video matching

Video matching

Matting and compositing

Titanic

Matting

Object selection

LazySnapping

Image-based modeling

photogrammetric modeling and projective texture-mapping

Image-based modeling

photogrammetric modeling and projective texture-mapping

Image-based modeling

photogrammetric modeling and projective texture-mapping

Image-based modeling

Tour into a picture

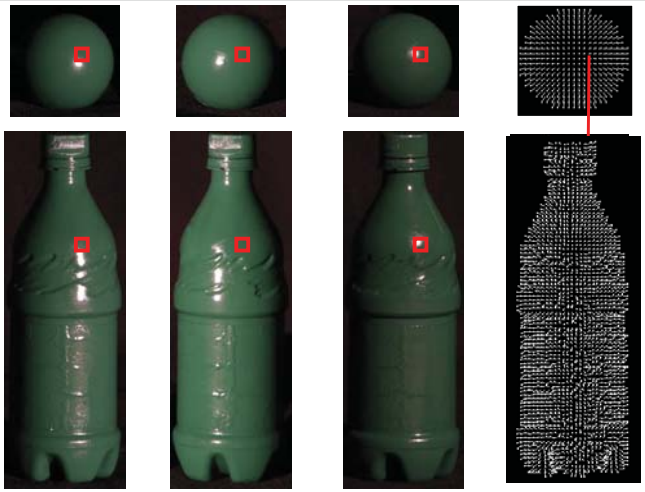
Image-based modeling

Tour into a picture

3D photography (active)

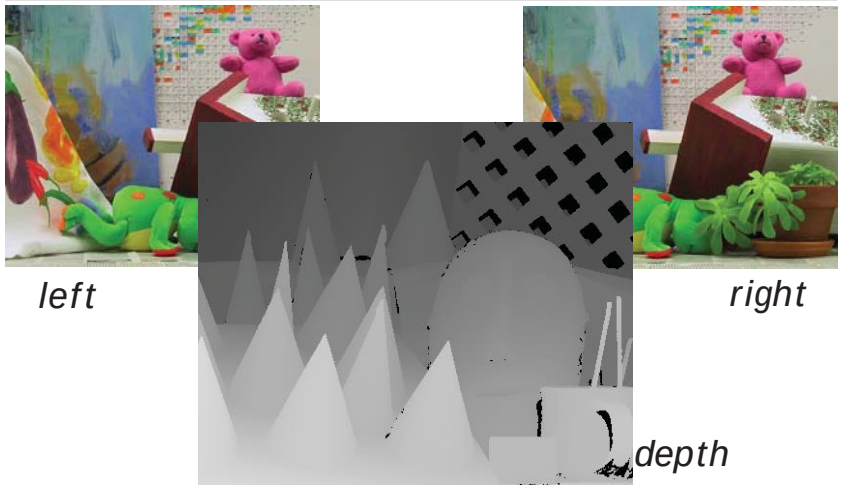
Cyberware whole body scanner

3D photography (active)



Photometric stereo

3D photography (passive)



left *right* *depth*

Stereo

Image-based rendering

Surface lightfield

View interpolation

Bullet time video

View interpolation

High-Quality Video View Interpolation

Image manipulation

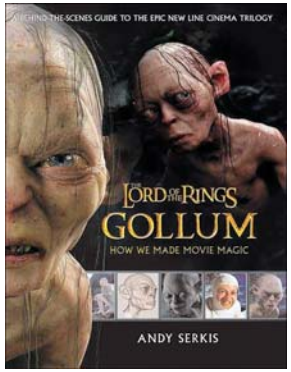
GraphCut Texture

Image manipulation

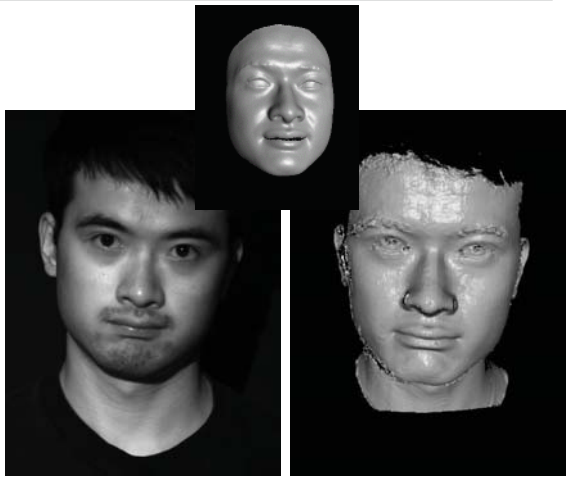
Poisson blending

Stereoscopic films

Making face

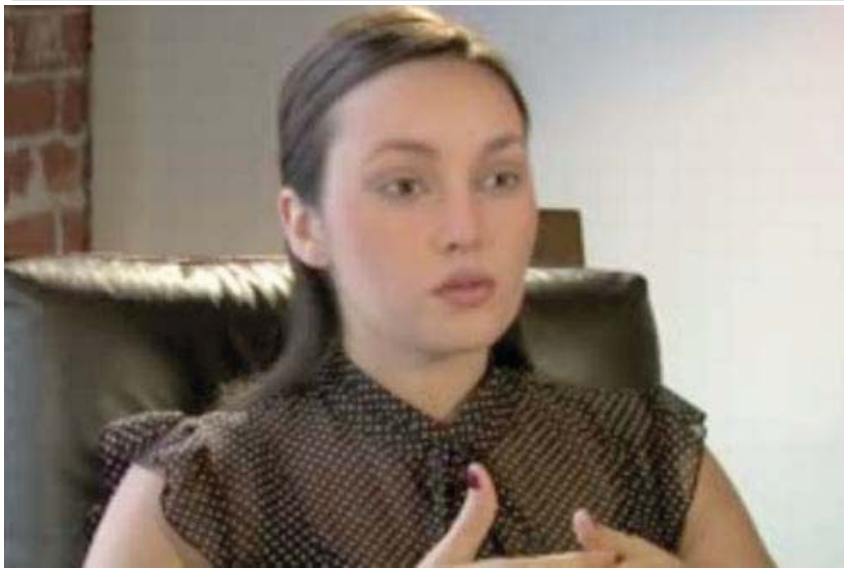


Gollum



Spacetime face

Virtual human



Virtual human

Video rewrite

Trainable videorealistic speech animation

Inpainting (wire removal)

Inpainting

Texture synthesis/replacement

Texture replacement

Semi-automatic matte painting

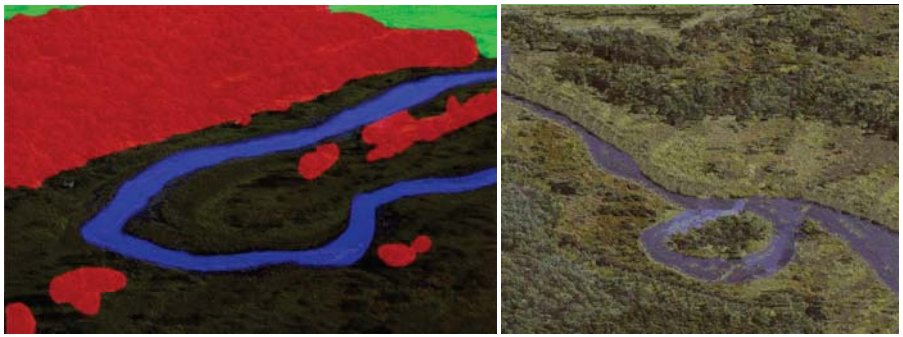
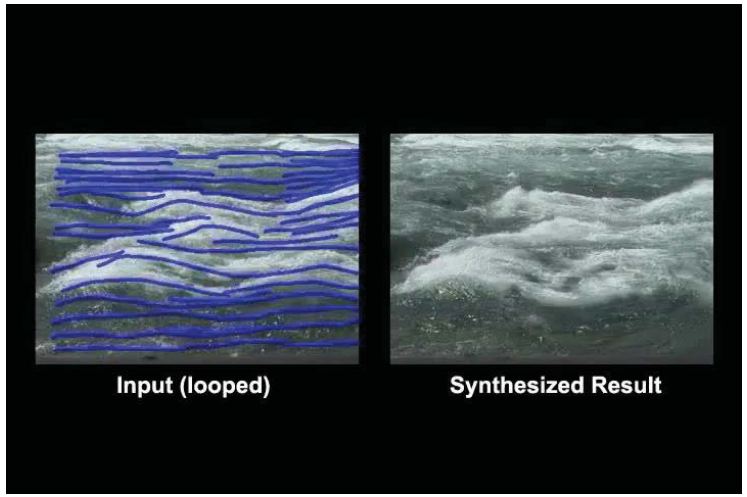


Image analogies

Video editing



Flow-based video editing

Grading (subject to change)

- 3 programming assignments (60%)
  - HDR Imaging (18%)
  - AutoStitch (24%)
  - MatchMove (18%)
- Class participation (5%)
- Final project (35%)
  - Research
  - System
  - Film

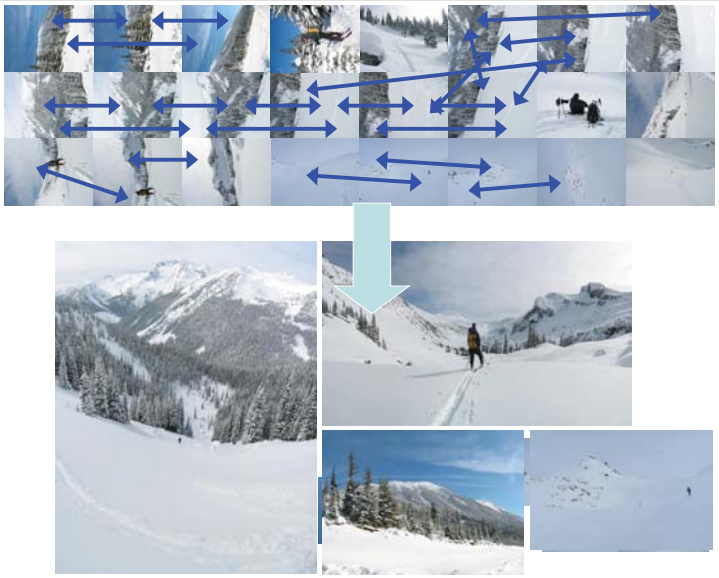
High dynamic range imaging

From past semesters (鄭逸廷 陳柏叡)

From past semesters (吳侑親, 張書瑋)

From past semesters (王瑋馥, 余雁雲)

AutoStitch



AutoStitch

羅聖傑

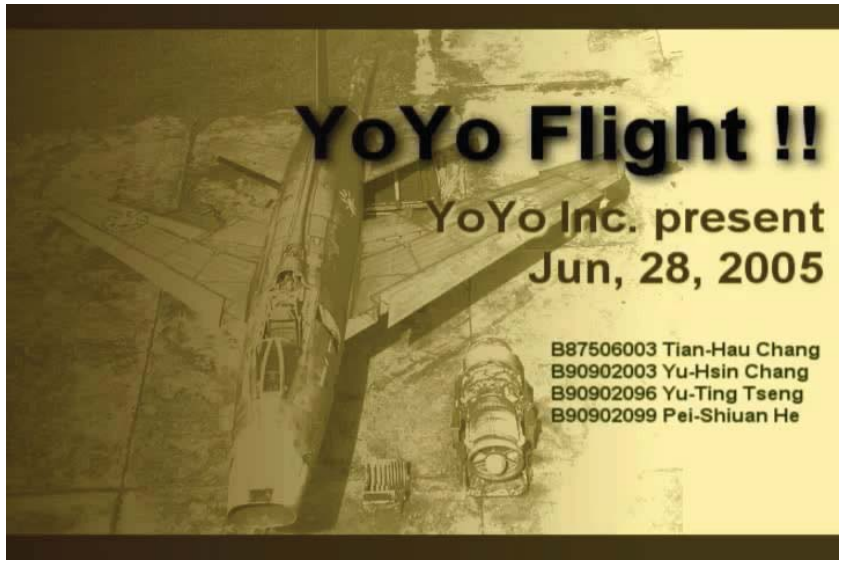
連奕婷 張宇蓓

MathMove 翁憲政 洪韶憶

MathMove 梁家愷 鐘志遠

Final projects from the past.

YoYo Flight



Making of YoYo Flight