

## Course overview

Digital Visual Effects

*Yung-Yu Chuang*

DigiVFX

## Logistics

- Meeting time: 2:20pm-5:20pm, Thursday
- Classroom: CSIE Room 104
- Instructor: Yung-Yu Chuang ([cyy@csie.ntu.edu.tw](mailto:cyy@csie.ntu.edu.tw))
- Teaching assistants: 張明旭
- Textbook: Readings from books, journals and proceedings. Richard Szeliski's [Computer Vision: Algorithms and Applications](#).
- .Webpage: (user name/password)  
<http://www.csie.ntu.edu.tw/~cyy/vfx>
- Mailing list: [vfx@cmlab.csie.ntu.edu.tw](mailto:vfx@cmlab.csie.ntu.edu.tw) subscribe via  
<https://cmlmail.csie.ntu.edu.tw/mailman/listinfo/vfx/>

This course is **NOT** about ...

DigiVFX

## It isn't about photography



## It isn't about 3D animations

DigiVFX



## It isn't about watching movies

DigiVFX



## It isn't about physical effects

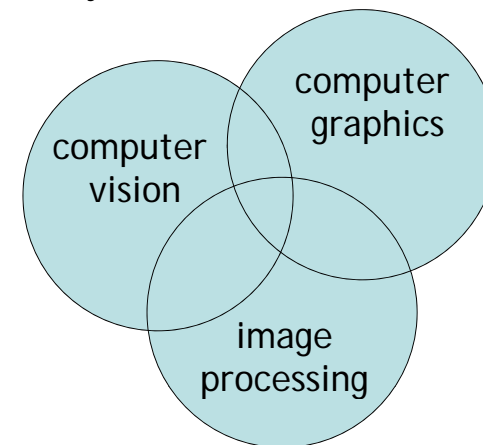
DigiVFX



## It's not about industrial tricks

DigiVFX

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.



## Prerequisites

DigiVFX

- 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

DigiVFX



what other professors  
think you do

what other students  
think you do

what you thought  
you will do



what you actually do

## Warning from previous students

DigiVFX

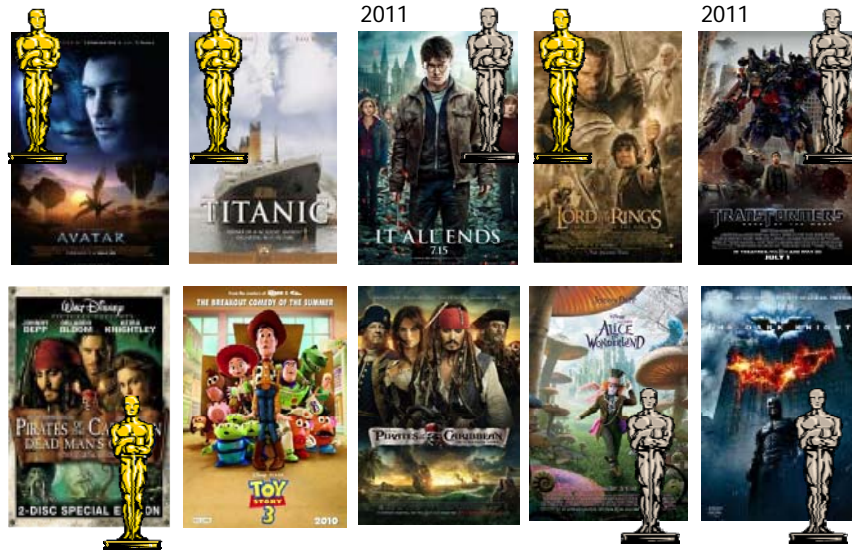
- 請學期初老師要多提醒這門課的困難度請興趣或實力不足同學勿修，否則就會像我一樣停修 XD

This course is about ...



## Digital Visual Effects

DigiVFX



## Reality?

DigiVFX



## Retouching

DigiVFX



## Iraq War, LA Times, April 2003

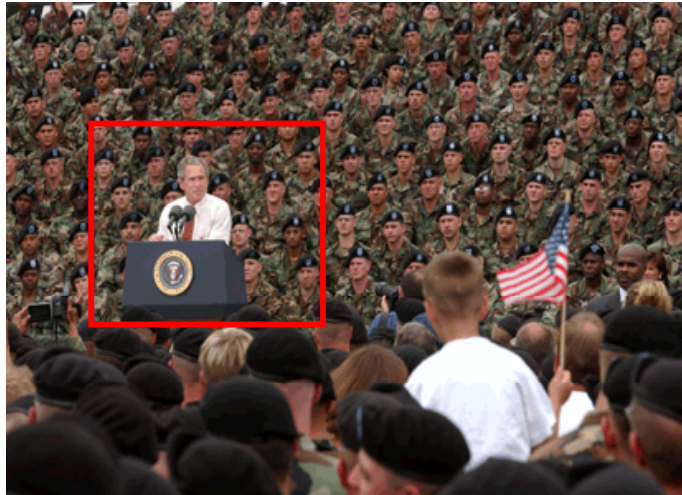
DigiVFX





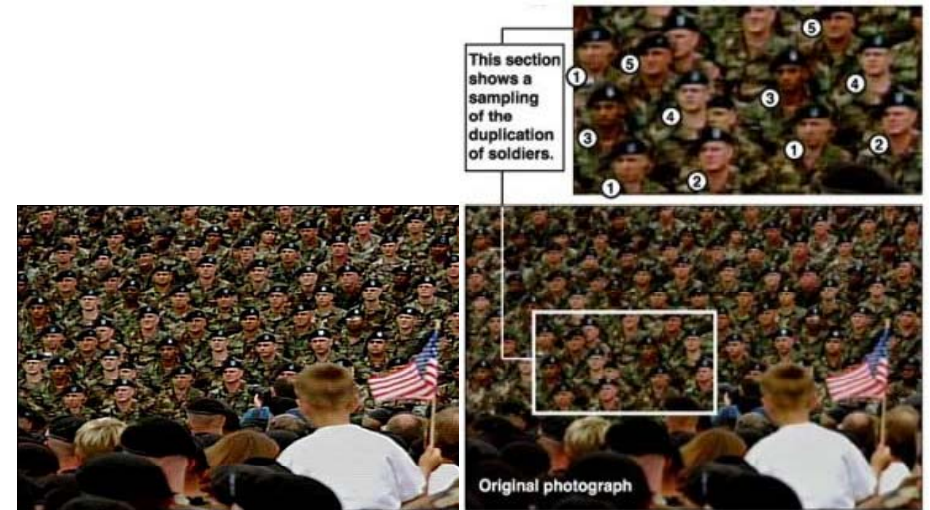
## Bush campaign's TV AD, 2004

DigiVFX



## Texture synthesis and inpainting

DigiVFX



## Domestic example

DigiVFX



The Liberty Times  
2007.12.17



Special effects

## Stop action

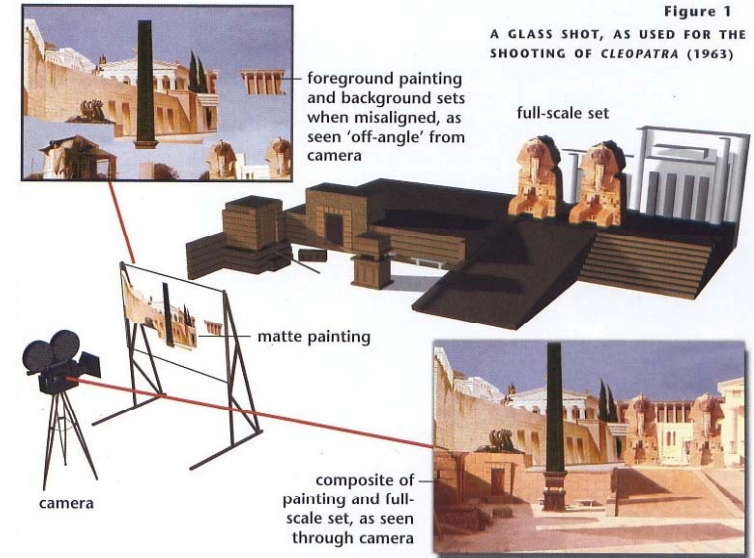
DigiVFX



*The execution of Mary, 1895*

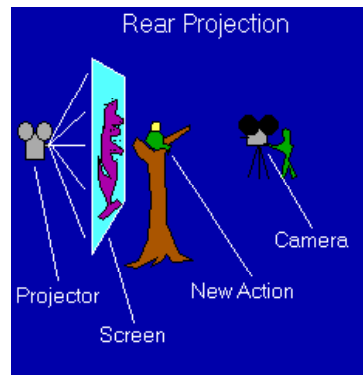
## Glass shot

DigiVFX



## Rear projection

DigiVFX



stop motion



*King Kong, 1933*

## Special effects (make-up)

DigiVFX





## Special effects (physical effects)

DigiVFX

Figure 7 CANNON CAR



## Special effects (miniature)

DigiVFX



## Special effects (matte painting)

DigiVFX



## Lord of the Rings

DigiVFX



## Illusion - forced perspective

DigiVFX



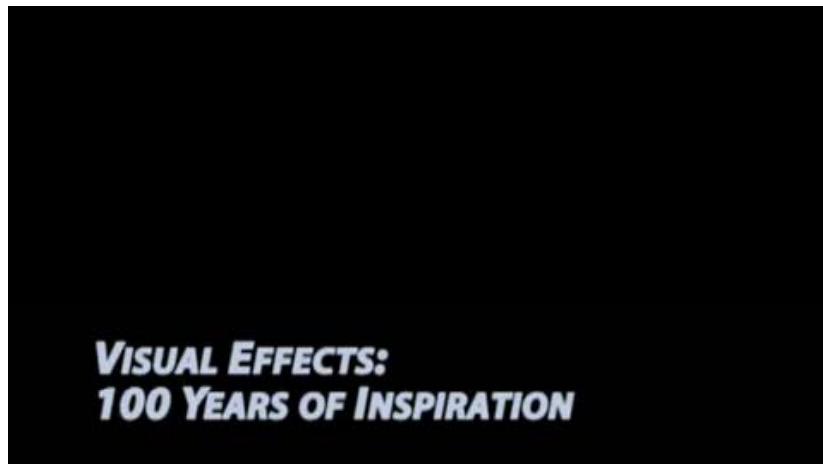
## Computer-generated model

DigiVFX



## Visual effects 100 Years

DigiVFX

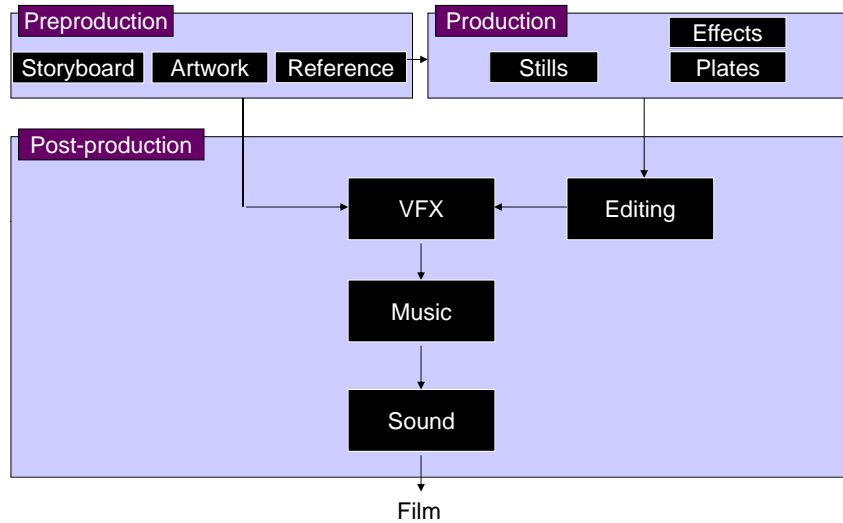


Production pipeline



## Production pipeline

DigiVFX



## Preproduction

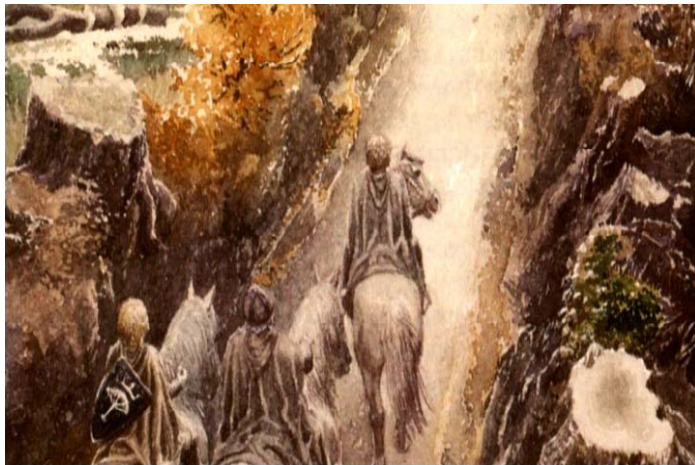
DigiVFX



Storyboard

## Preproduction

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Artwork

## Preproduction

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Reference & Research

## Production

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Shooting

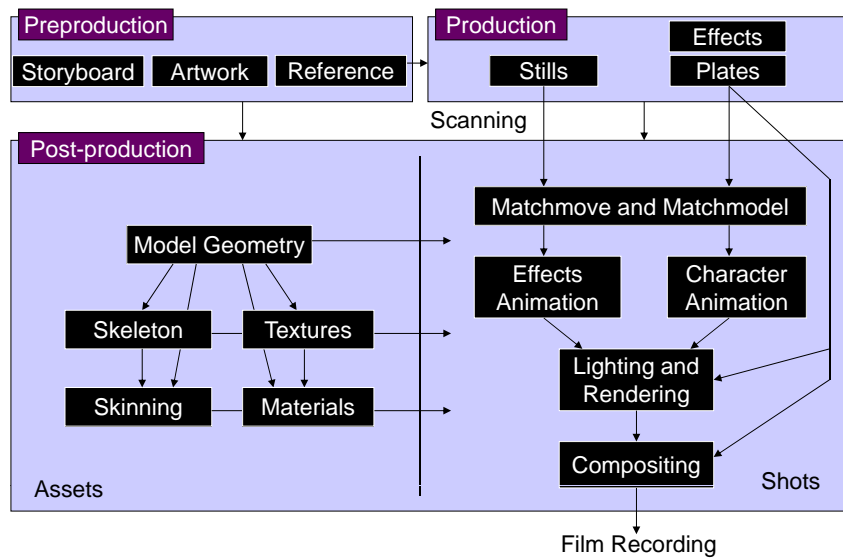
## Post-production

DigiVFX



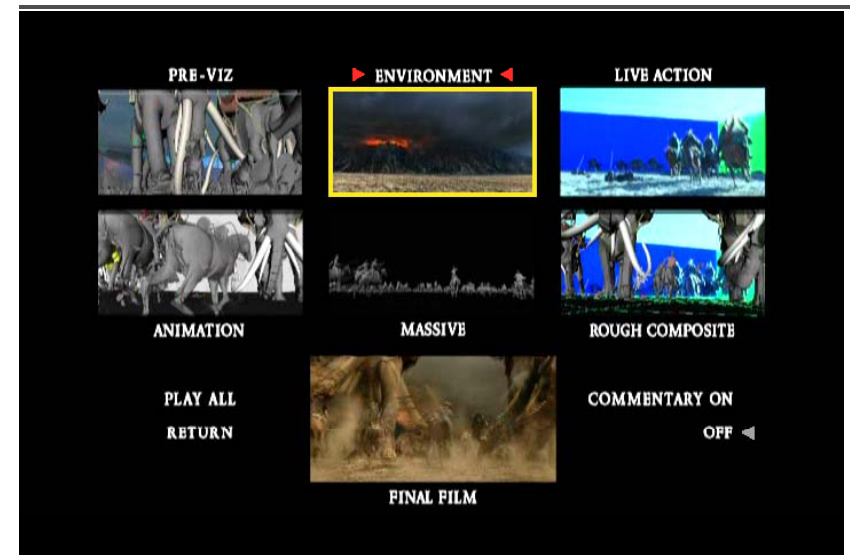
## Visual effects production

DigiVFX



## Visual effects post-production

DigiVFX





## A case study

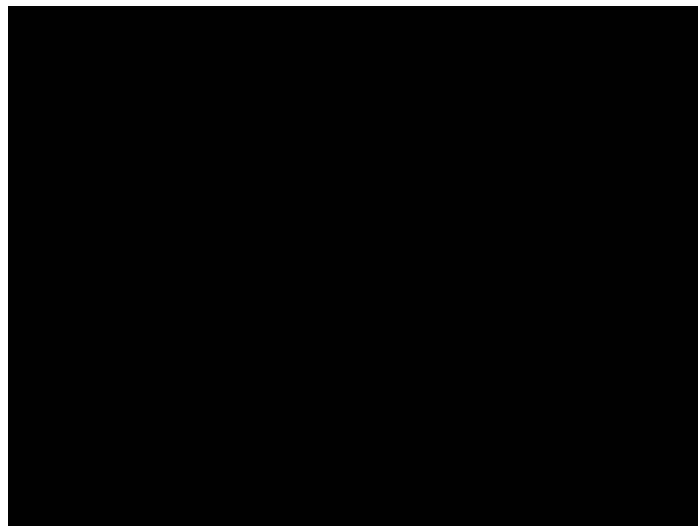
### 405: The Movie



- 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.
- <http://www.405themovie.com/>



### 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

DigiVFX

### Step 1: shooting

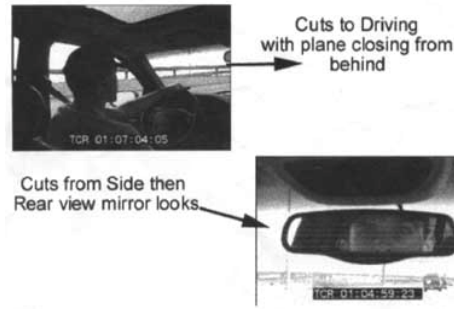
two days with a Canon Optura DV camera with progressive mode.

⇒ a 70-minute raw footage



### initial editing

⇒ pickup shots



## Making of 405

DigiVFX

### 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

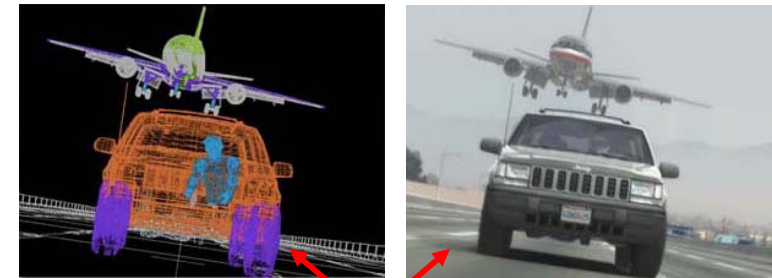


photo-based 3D environment

## Making of 405

DigiVFX

Real cars were used for close-up and interior shots



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

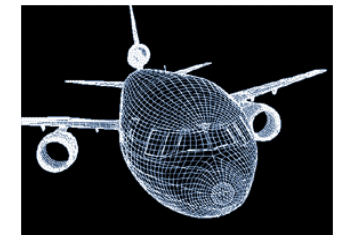


## Making of 405

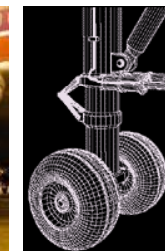
DigiVFX

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

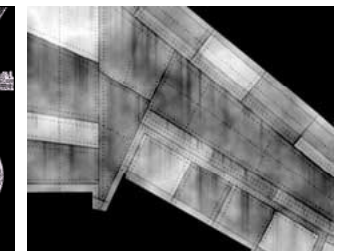
59 objects, 142,439 polygons



reference



modeling



material painting



## Making of 405

DigiVFX

### Step 3: traffic clearing

clean plate



close-up shots



inpainting

## Making of 405

DigiVFX

### Step 4: compositing



shot with the vehicle standing still in a backyard



## Making of 405

DigiVFX



## Making of 405

DigiVFX

### Step 5: fine touchup



3D hat

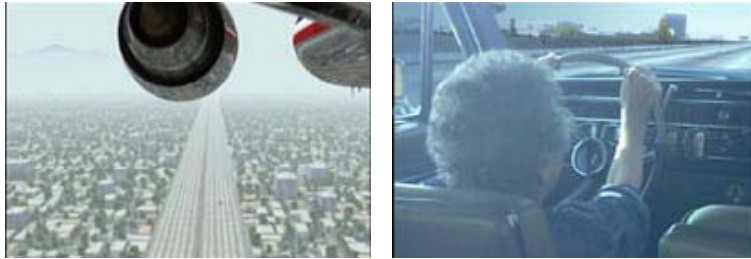


compositing and inpainting

## Making of 405

DigiVFX

Step 6: music and delivery



## Bloody Omaha

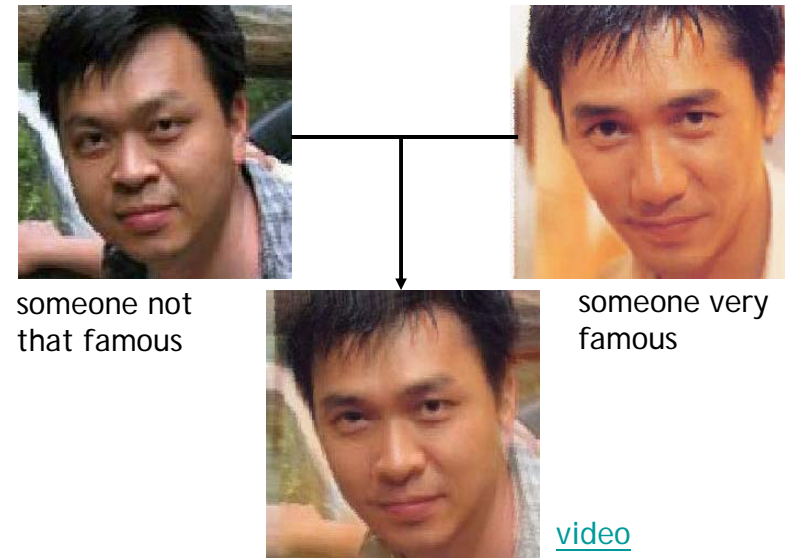
DigiVFX



Topics we plan to cover

## Image warping/morphing

DigiVFX





## Image warping/morphing

DigiVFX



## Tracking

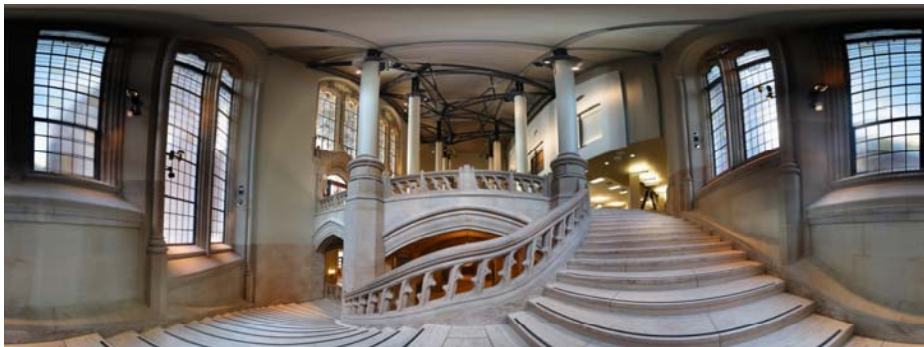
DigiVFX



Feature tracking

## Image stitching

DigiVFX



## MatchMove

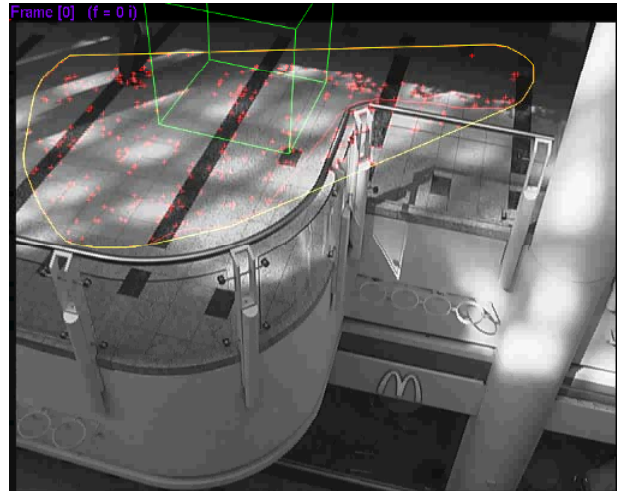
DigiVFX



*Move matching using scene planes*

## Matchmove

DigiVFX



*Move matching using scene planes*

## Matchmove

DigiVFX



*Move matching using scene planes*

## Photo tourism

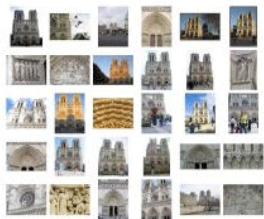
DigiVFX



### Photo Tourism

Exploring photo collections in 3D

Microsoft



(a)



(b)



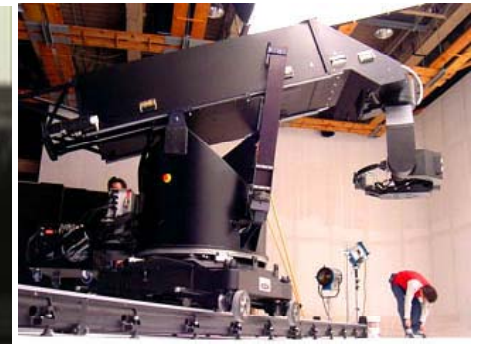
(c)

## Video matching

DigiVFX



*Matrix*



*MOCO (Motion control camera)*



## Video matching

DigiVFX



*Video matching*

## Matting and compositing

DigiVFX



*Titanic*

## Matting

DigiVFX



## Object selection

DigiVFX



*LazySnapping*

## Image-based modeling

DigiVFX



*photogrammetric modeling and projective texture-mapping*

## Image-based modeling

DigiVFX



*photogrammetric modeling and projective texture-mapping*

## Image-based modeling

DigiVFX



*photogrammetric modeling and projective texture-mapping*

## Image-based modeling

DigiVFX



*Tour into a picture*



## Image-based modeling

DigiVFX



*Tour into a picture*

## 3D photography (active)

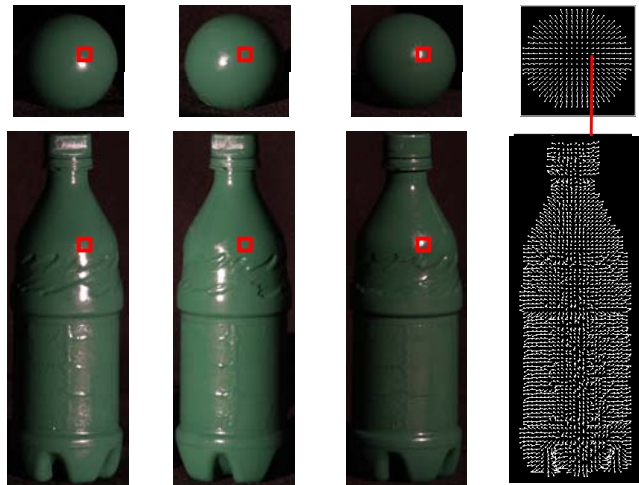
DigiVFX



*Cyberware whole body scanner*

## 3D photography (active)

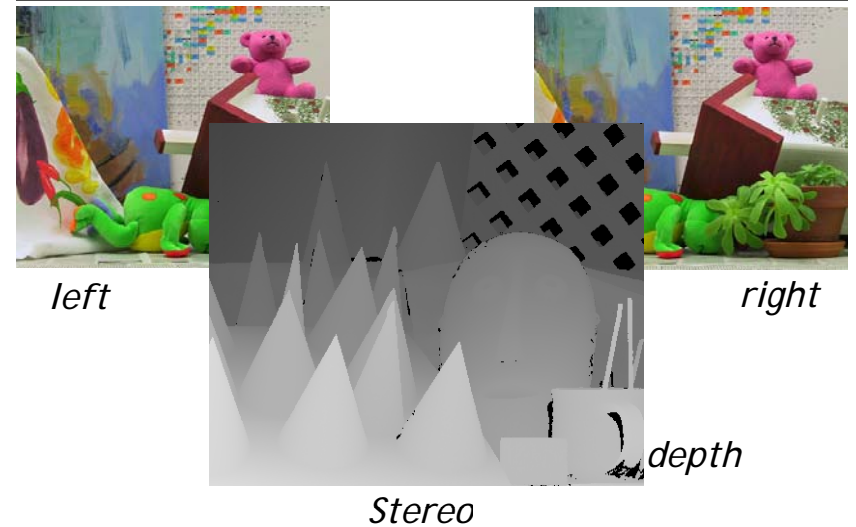
DigiVFX



*Photometric stereo*

## 3D photography (passive)

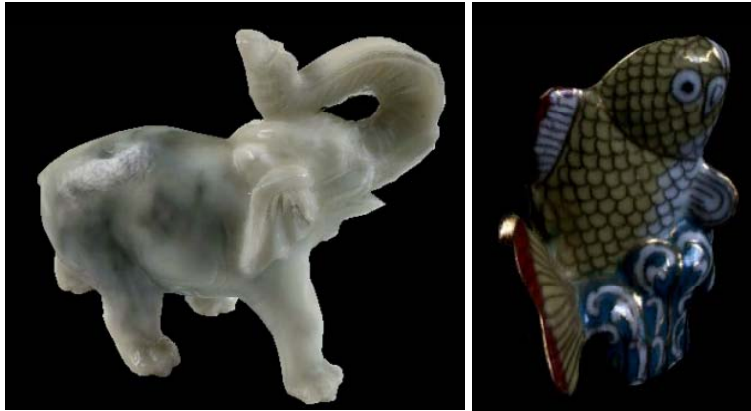
DigiVFX





## Image-based rendering

DigiVFX



*Surface lightfield*

## View interpolation

DigiVFX



Bullet time video

## View interpolation

DigiVFX



High-Quality Video View Interpolation

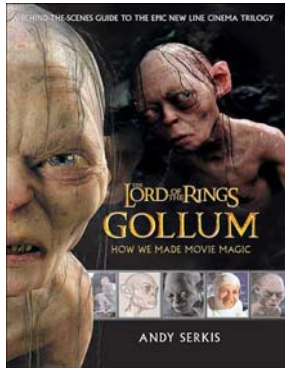
## Stereoscopic films

DigiVFX

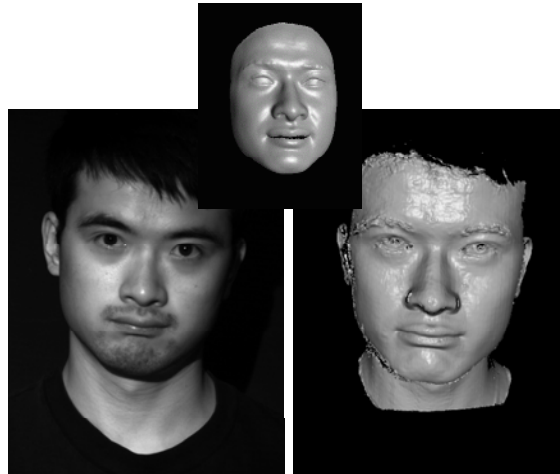


## Making face

DigiVFX



*Gollum*



*Spacetime face*

## Video rewrite

DigiVFX



Trainable videorealistic speech animation

## Inpainting (wire removal)

DigiVFX



*Inpainting*

## Texture synthesis/replacement

DigiVFX

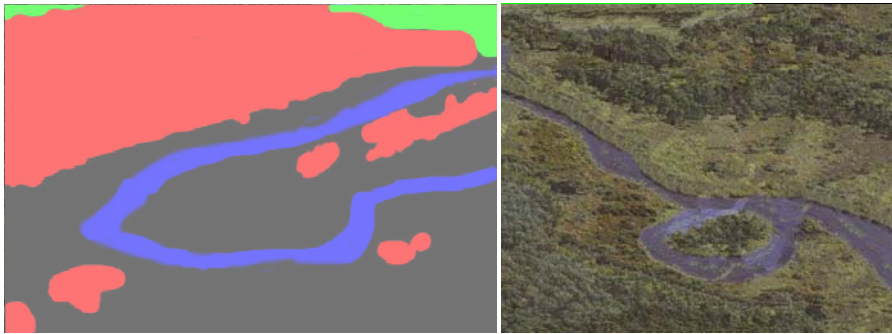


*Texture replacement*



## Semi-automatic matte painting

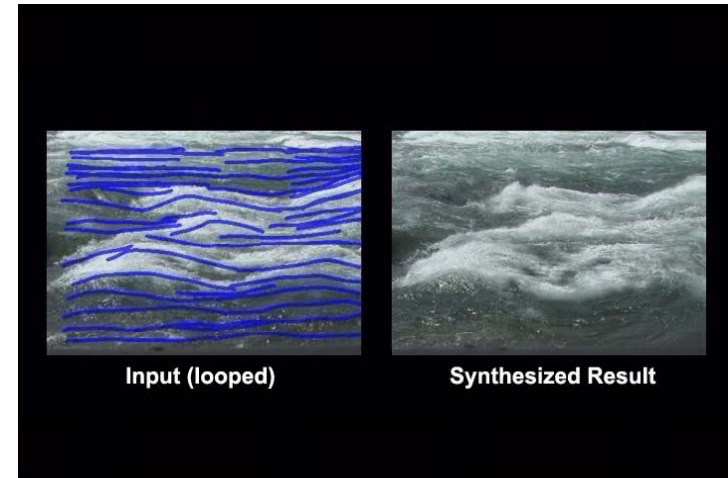
DigiVFX



*Image analogies*

## Video editing

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*Flow-based video editing*

## Grading (subject to change)

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

## Morphing

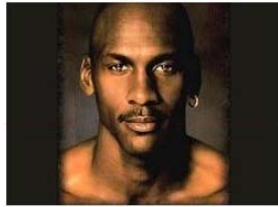
DigiVFX





## Morphing

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source #1



source #2



source #3



source



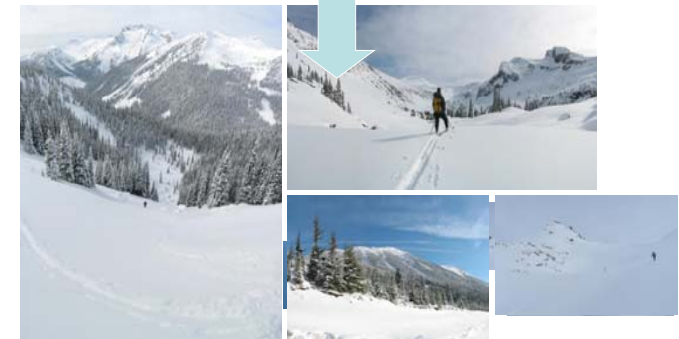
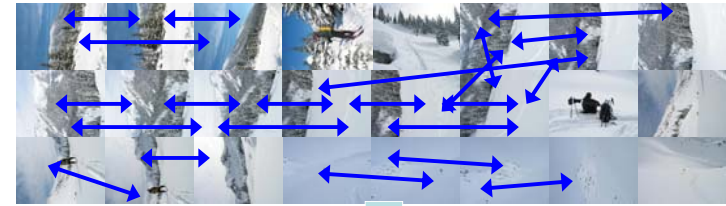
morph



destination

## AutoStitch

DigiVFX



## AutoStitch

DigiVFX



羅聖傑



連奕婷 張宇蓓

## MathMove

DigiVFX



梁家愷 鐘志遠



姜任遠 林立峯



楊宗碩 林柏劭

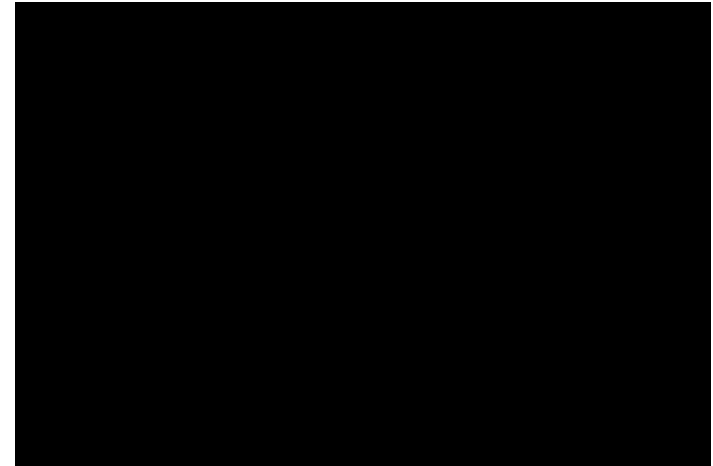


翁憲政 洪韶憶

Final projects from a similar course  
in Georgia Tech.

## Life in Paints

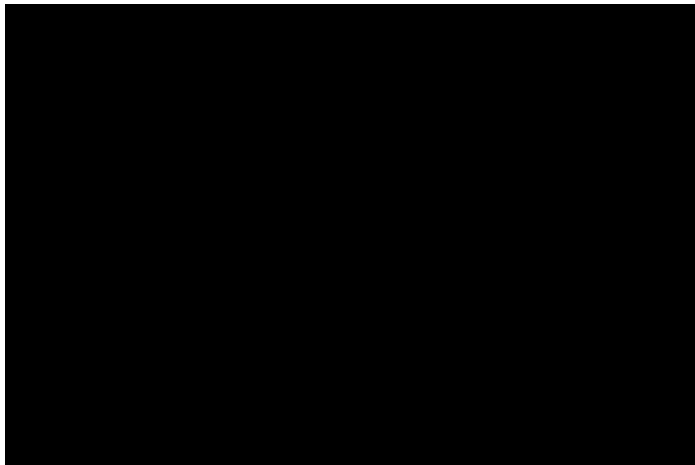
DigiVFX



*Life in Paints*, GaTech DVFX 2003

## Tour into pictures

DigiVFX



Making of *Life in Paints*

## In Your Face

DigiVFX



*In Your Face*, GaTech DVFX 2002

## Stop action

DigiVFX

The Making Of  
In Your Face

Making of *In Your Face*

## Tennis

DigiVFX

*Tennis*, GaTech DVFX 2007

## MatchMove/CGI

DigiVFX

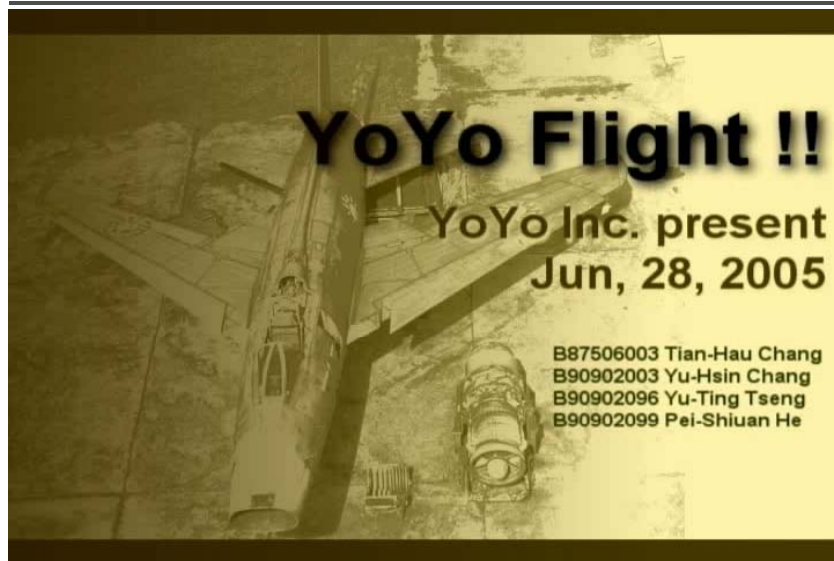
*Making of Tennis*

**Final projects from the past.**



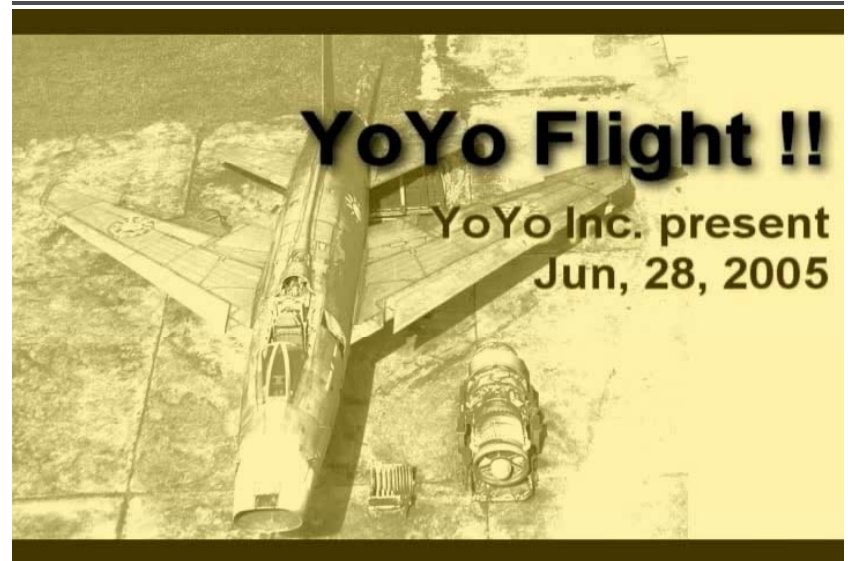
## YoYo Flight

DigiVFX



## Making of YoYo Flight

DigiVFX



## That's it for today!

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- Don't forget to subscribe the mailing list.
- Check out the course website.