



Image Matting and Composition

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This slide is part of teaching materials for
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Agenda

- Part of this lecture is adapted from CSCI 129 Computational Photography course
(<http://cs.brown.edu/courses/csci1290/>)

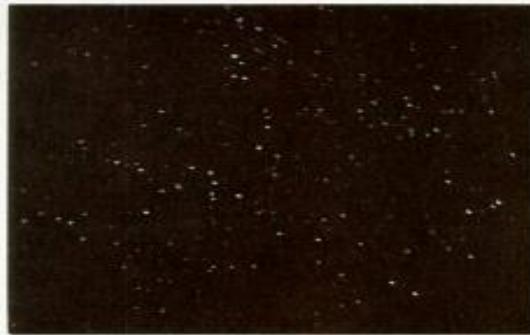


Outline

- Image Composition
- Matting Process
- Blue Screen Matting
- Environment/Shadow Matting
- Recent Matting Techniques (Knockout/Bayesian/Grabcut/Poisson)
- Interactive Matting Techniques (Robust matting/Easy matting/Closed-form matting)
- Flash Matting
- Video Matting (Video cutout/Video defocus/Camera Array matting)



Digital Image Composition



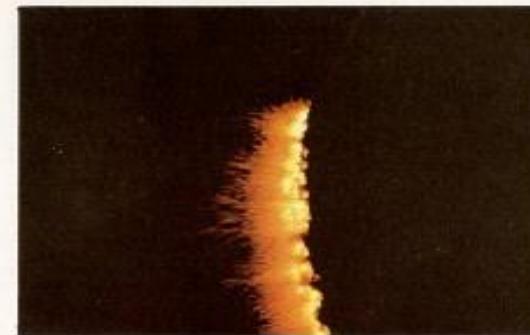
Stars



Planet



BFire



FFire



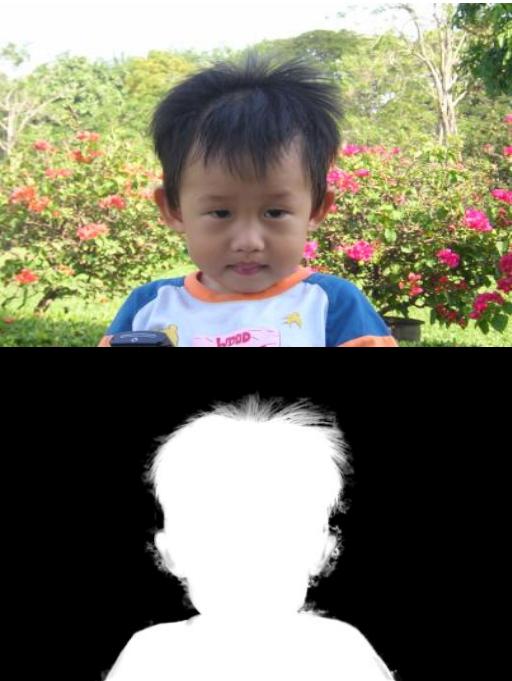
BFire out Planet



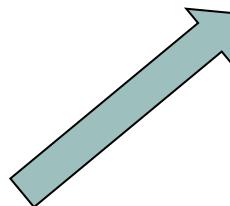
Composite



Digital Image Composition



Matte



How does Superman fly?



Pulling a matte

Problem Definition:

- The separation of an image into
 - A foreground object image
 - A background image
 - An alpha matte

Hard problem



Matte creation

- From digitized images
 - Blue-screen matting
 - Video or chroma-keying
 - Image processing



Blue Screen



Nothing special about blue



Digital Matting Equation

- For each pixel

$$C = \alpha F + (1 - \alpha)B$$

- C : Rendered Color
- F : Foreground color
- B : Background color
- α : Amount of light passing through the foreground – called the Alpha-Channel



Challenges to Matting & Compositing

- Extracting the Matte (alpha channel) from natural scenes
- Handling the occluding contour?
- Foreground has color of background
- Refracted and reflected light
- ...



Challenges to Matting & Compositing



What about semi-transparent mattes?



Drinking water advertisement, Realistic?



อยากเห็นคุณ
ดี๊ด๊ะ...สิงที่ใช่



ใช่... เพราะพาน Teknology
 SMART
MICRO FILTER จึงสะอาดเหมือนร่างกาย

Drinking water advertisement, Realistic?

ข.16/2561

เดร่องดีม

น้ำเปล่า คริสตัล

ภาษาไทย

น้ำซุป

น้ำ



หมายเหตุ : ผลิตภัณฑ์ เป็นการรีเมคของกิจการเดิม ที่นำร่อง ให้เป็นการรับรองคุณภาพการผลิตของผู้ผลิตเมืองไทย ให้สามารถ เว็บไซต์ กิจกรรมนี้เปิด ตั้งแต่วันที่ 20/02/2560 ถึงวันที่ 22/02/2560 สำหรับผู้ที่เข้าร่วมกิจกรรม ทางเว็บไซต์ ได้รับรางวัล ตามเงื่อนไขที่กำหนด จำนวน 1,000 บัญชี สำหรับการรับของทุกๆ ผู้เข้าร่วมกิจกรรม ที่ได้รับรางวัล 2500 - ไม่เกินจำนวน 2500

คิดจะดื่มน้ำ...ดื่มคริสตัล



สั่งน้ำดีม
เจาะจงคริสตัล
น้ำดีมจากผู้ผลิตที่บี



Crystal Drinking Water





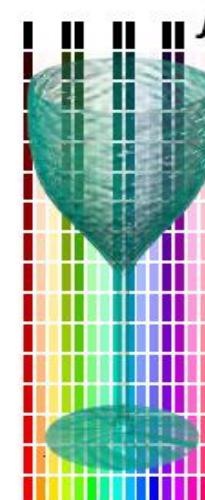
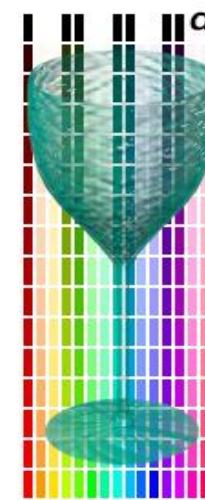
**How about \$30
bottled air range
for homesick
expats ads?**

- [https://edition.cnn.com/travel/article/u k-company-launches-30-bottled-air/index.html](https://edition.cnn.com/travel/article/u-k-company-launches-30-bottled-air/index.html)

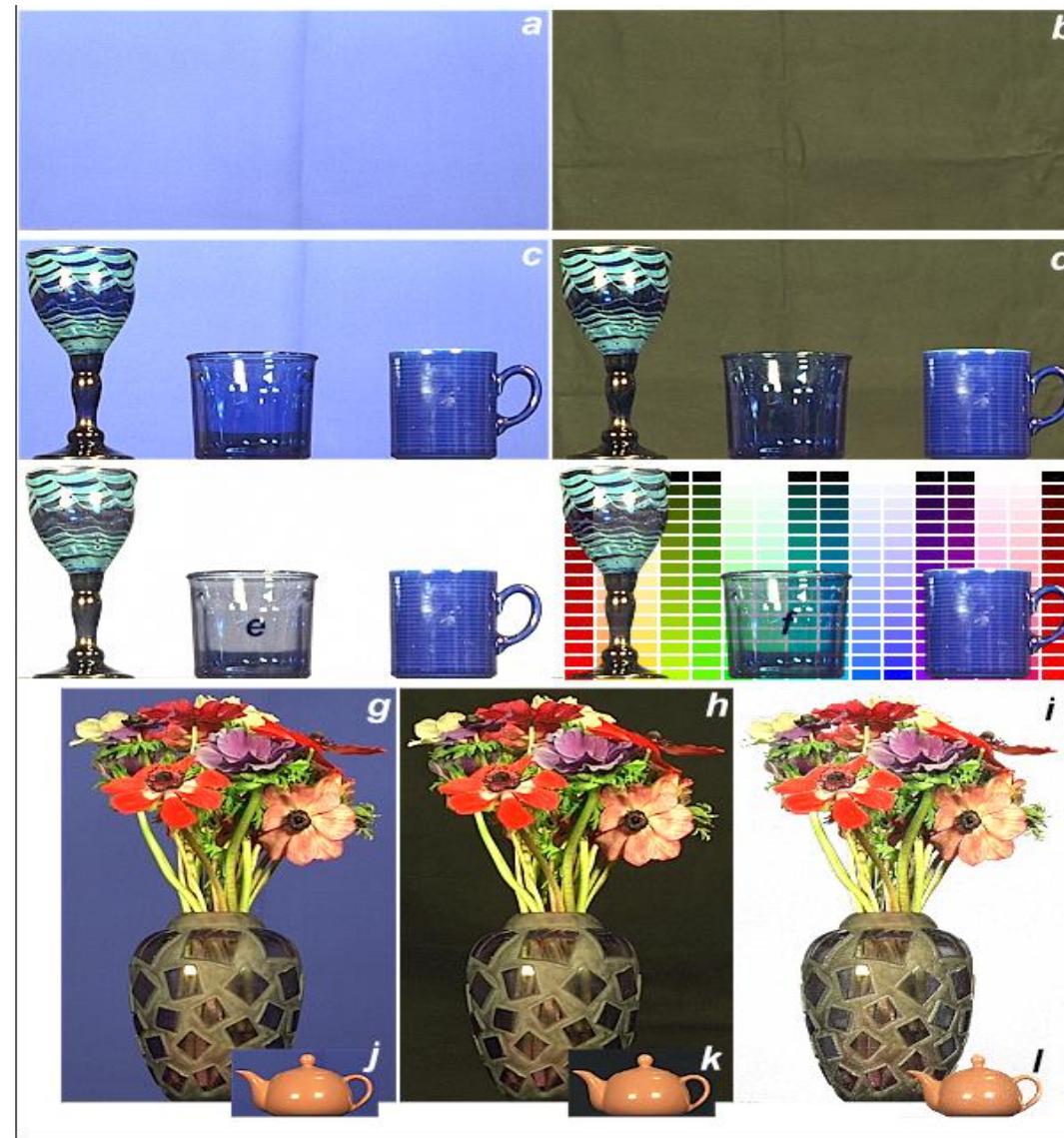
We want a semi-transparent matte



Solution...



More example...



Problems with Matting

- Images do not look realistic
- Lack of Refracted Light
- Lack of Reflected Light

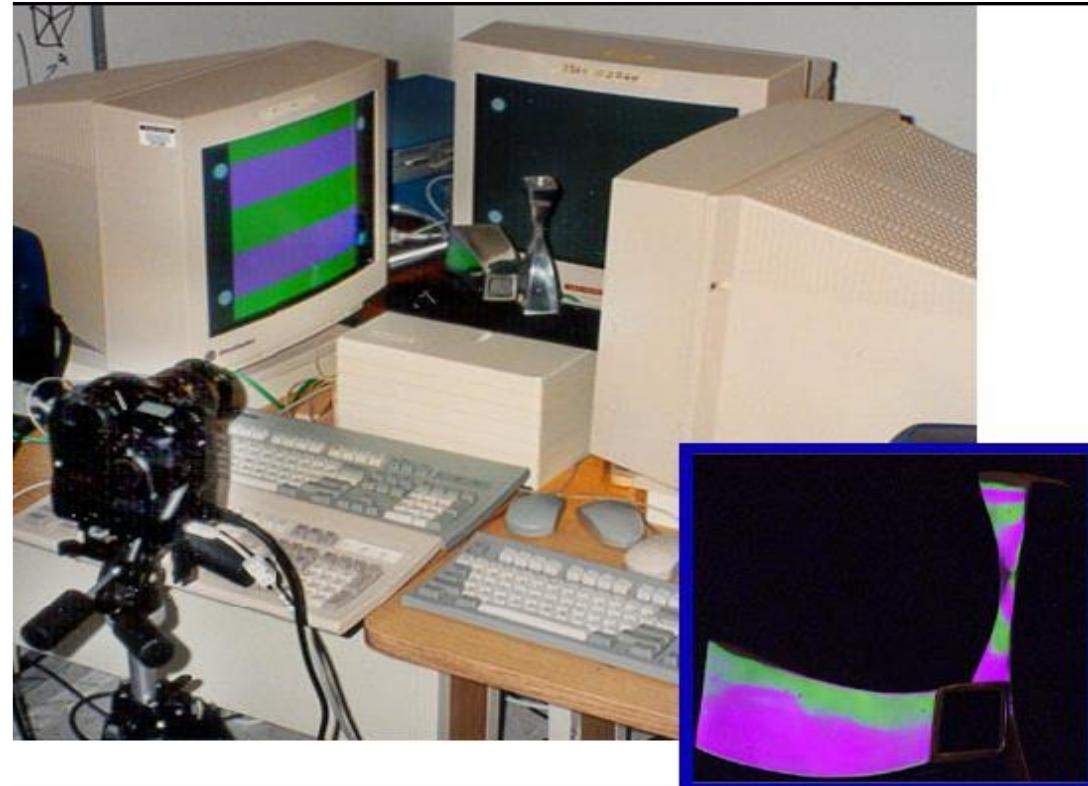
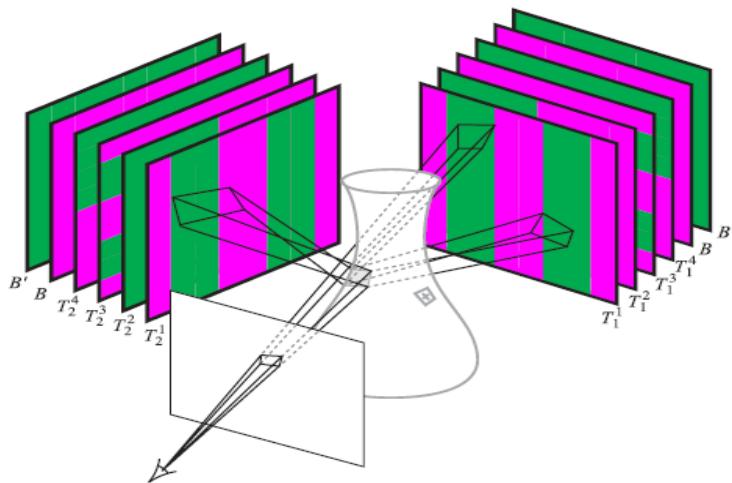


Environment Matting and Composition

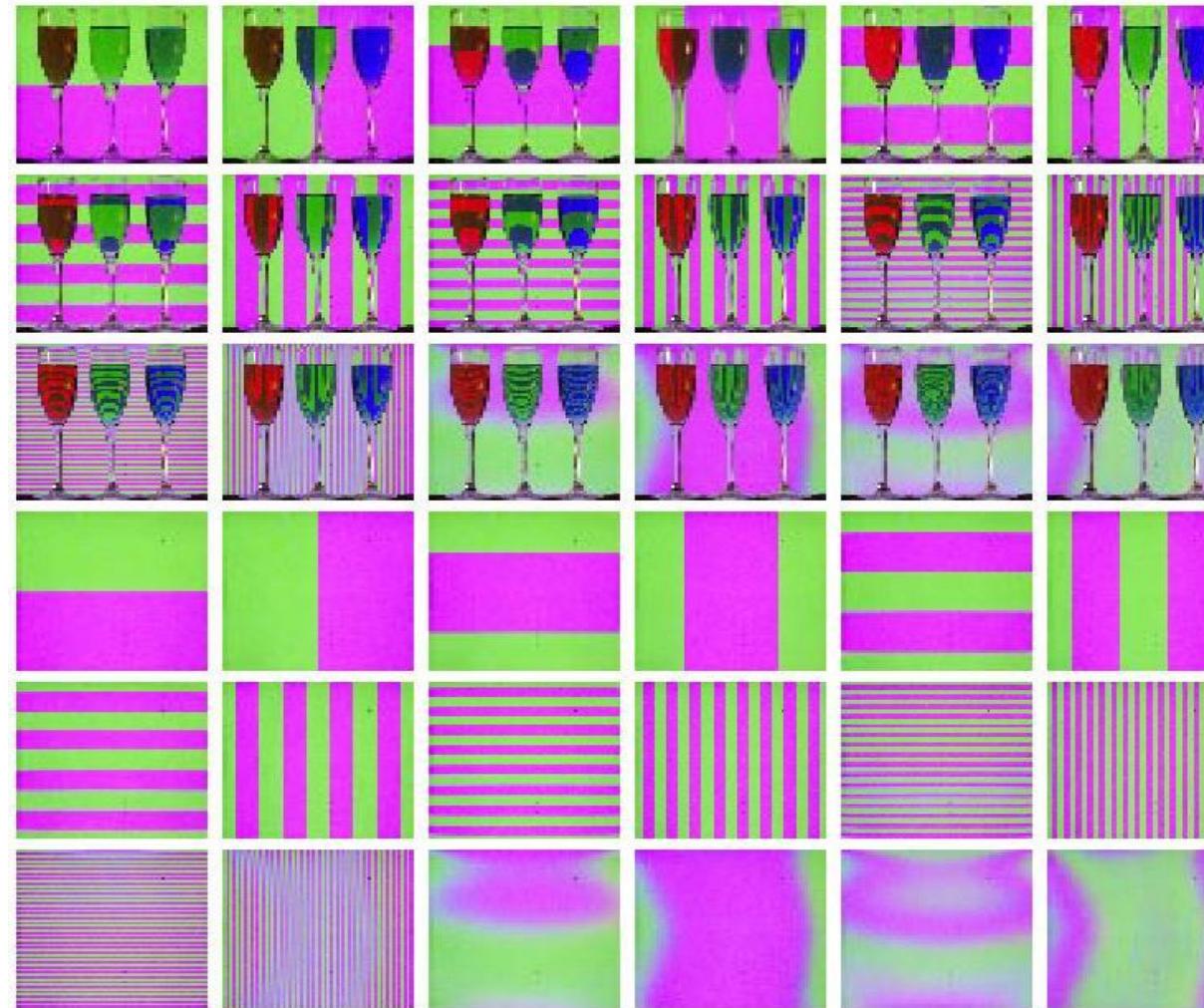


Process of environment matting

- Learn how light is reflected and refracted from a backdrop and from various sidedrops



Process of environment matting



Results of environment matting



Results of environment matting



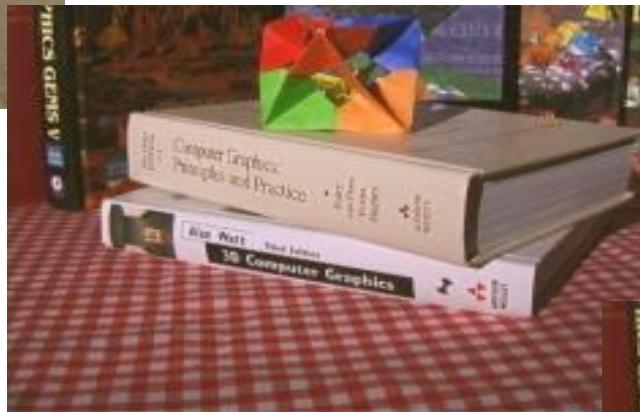
Movies of environment matting



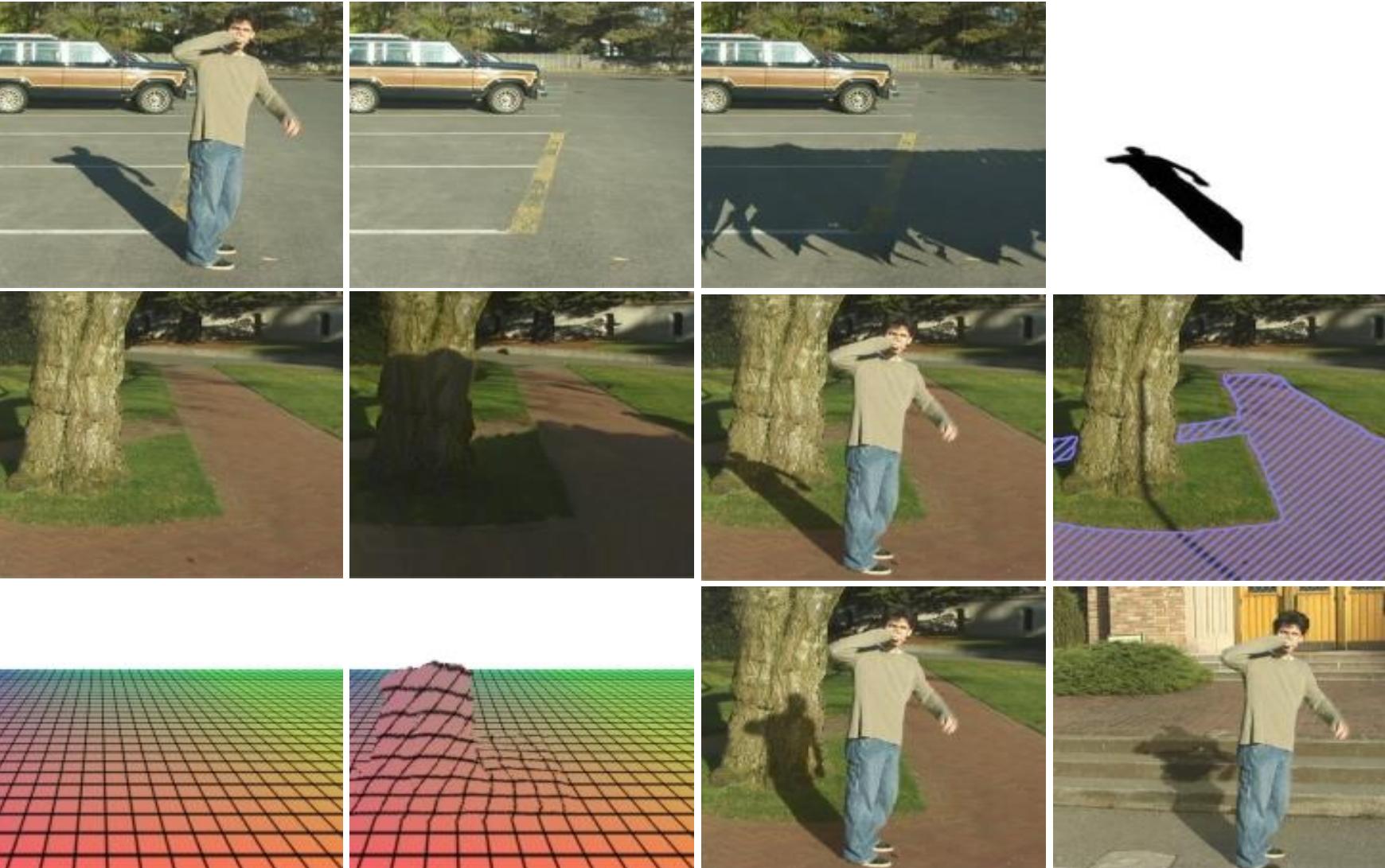
Show clips – [goblet](#), [book](#), [morph](#)



Shadow matting and compositing



Shadow matting and compositing



Shadow matting

- Show clip [ShadowMattingDivXS.avi](#)

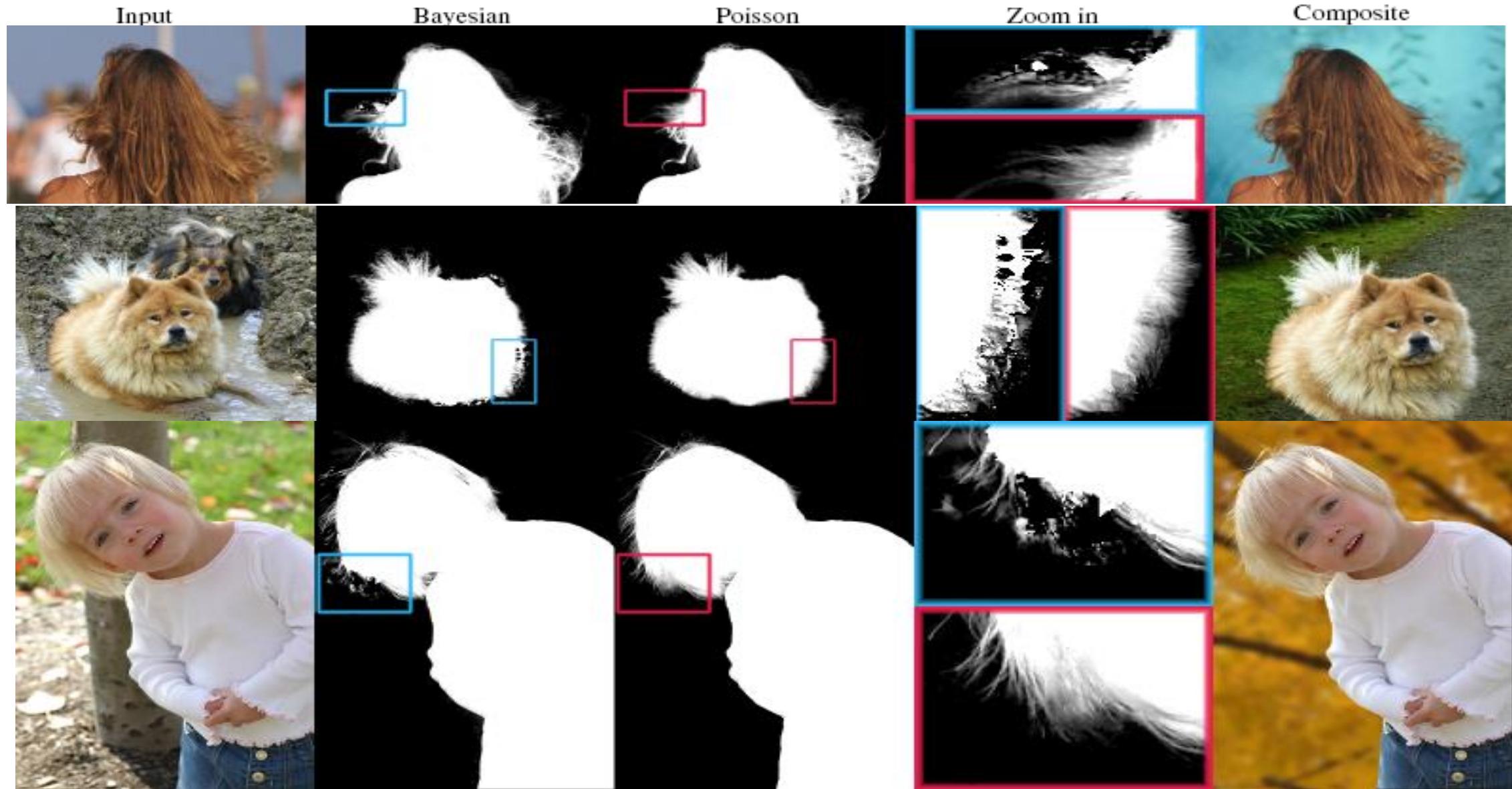


Natural image matting

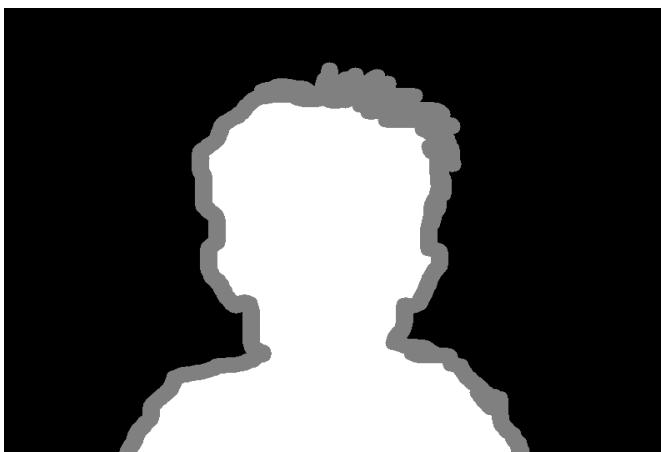
- Bayesian approach



Natural image matting

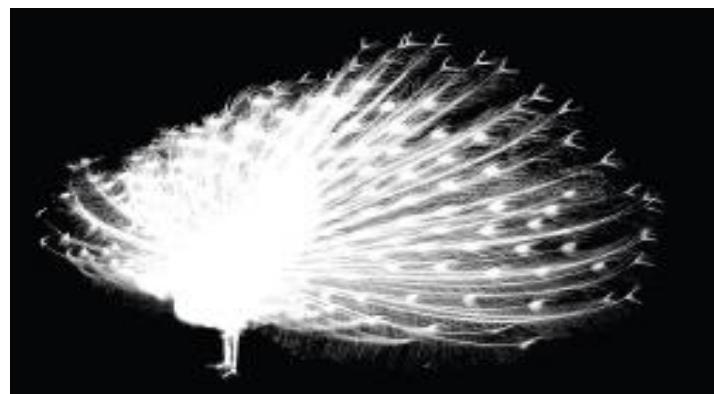
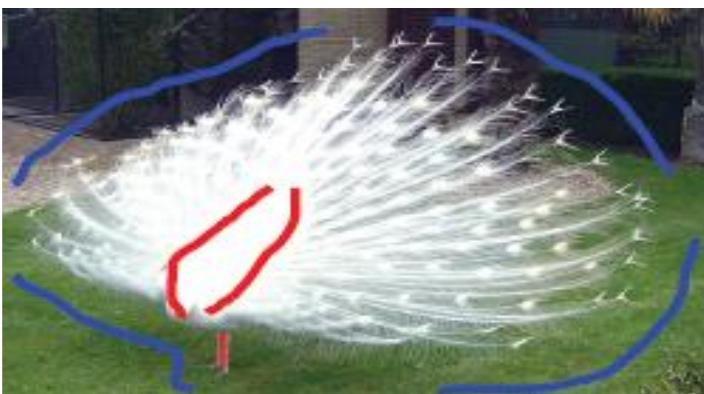


Levels of user interaction



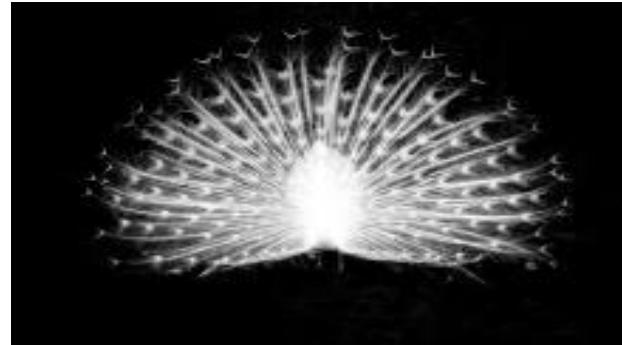
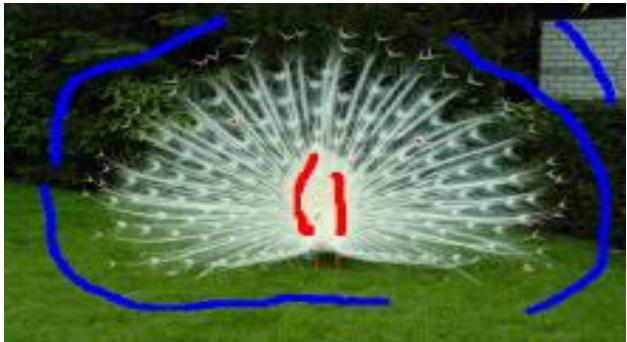
Interactive matting

- Easy matting



Interactive matting

- Closed form matting



Interactive matting

- Soft Scissors



Flash matting

- Extract mattes using a pair of flash/no-flash images



Image Matting is Difficult

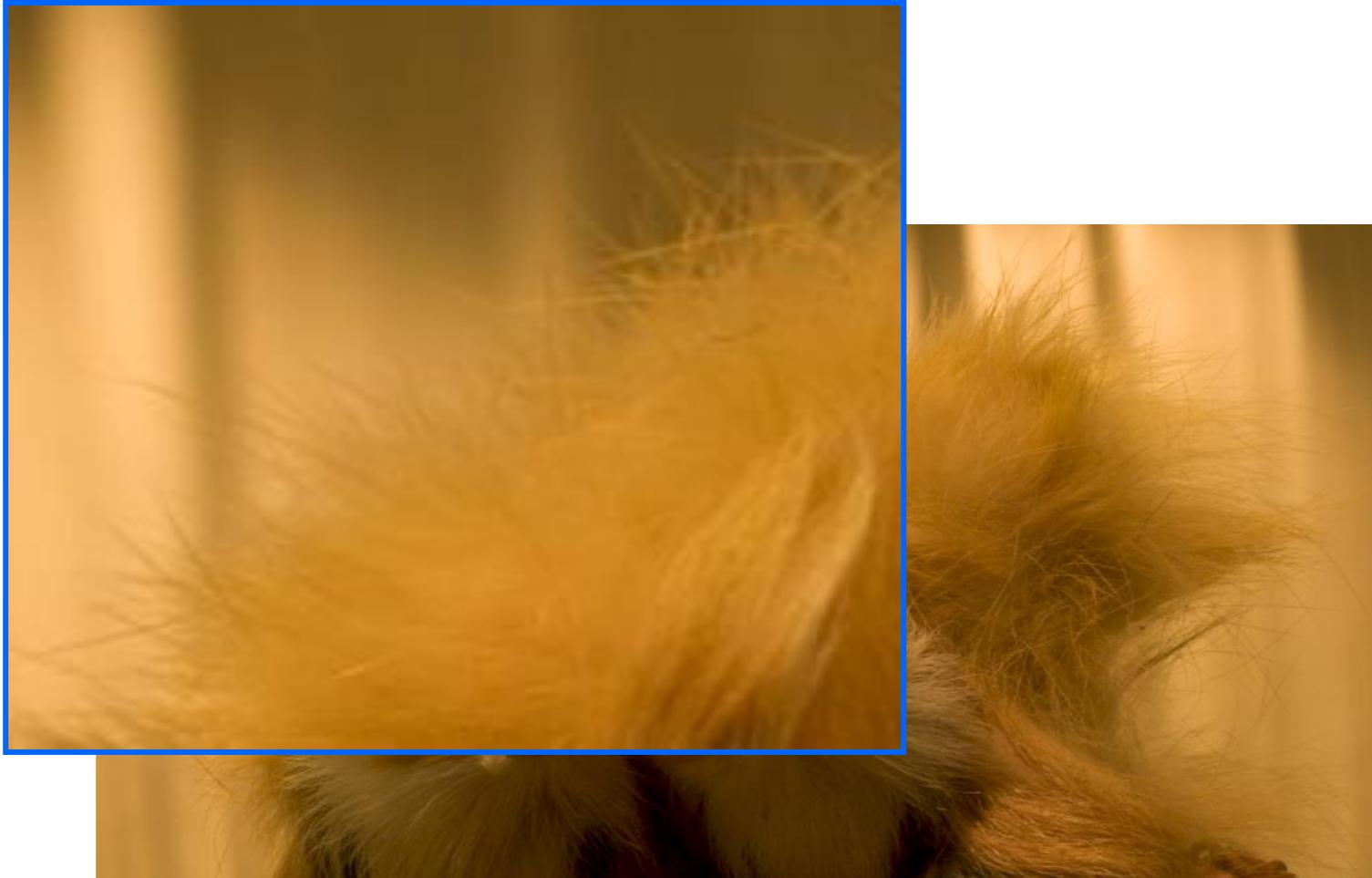
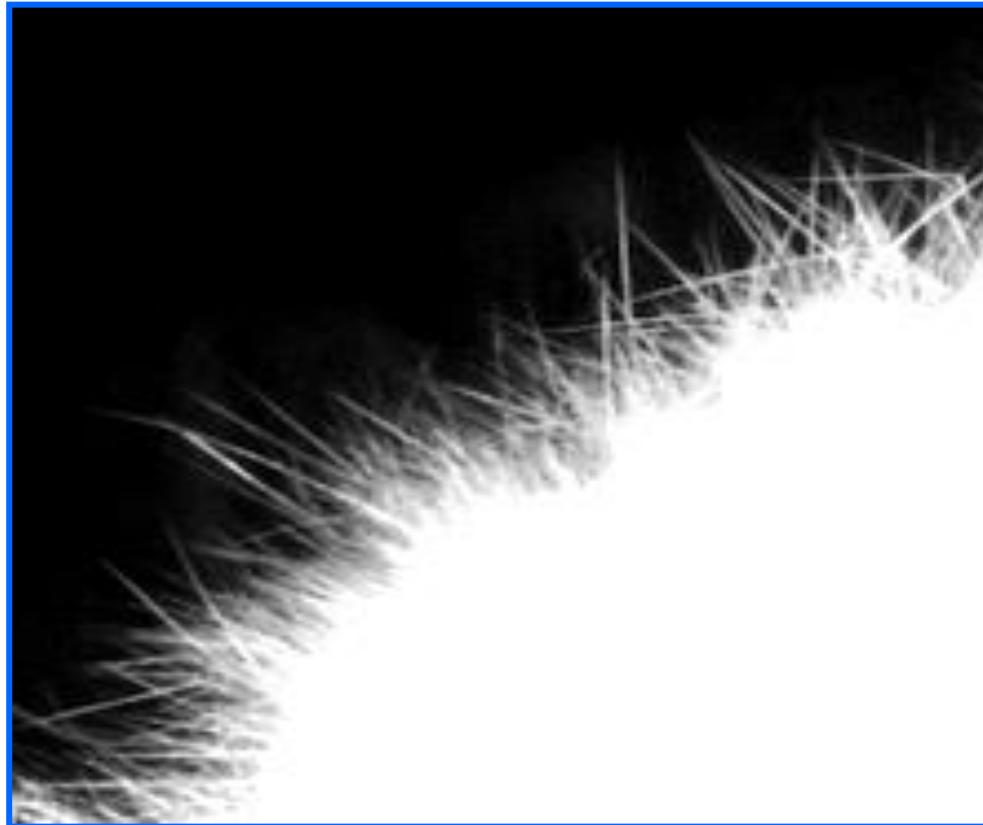


Image Matting is Easy with **FLASH**



Flash Matting



Flash matting

- Show clip FlashMatting.wmv



Video

- Let's understand the nature of video clip
- A sequence of image frames
- Show videoCubism.avi



Video matting

- Easier or more difficult?
- Issues...
- Show VideoCutout.avi

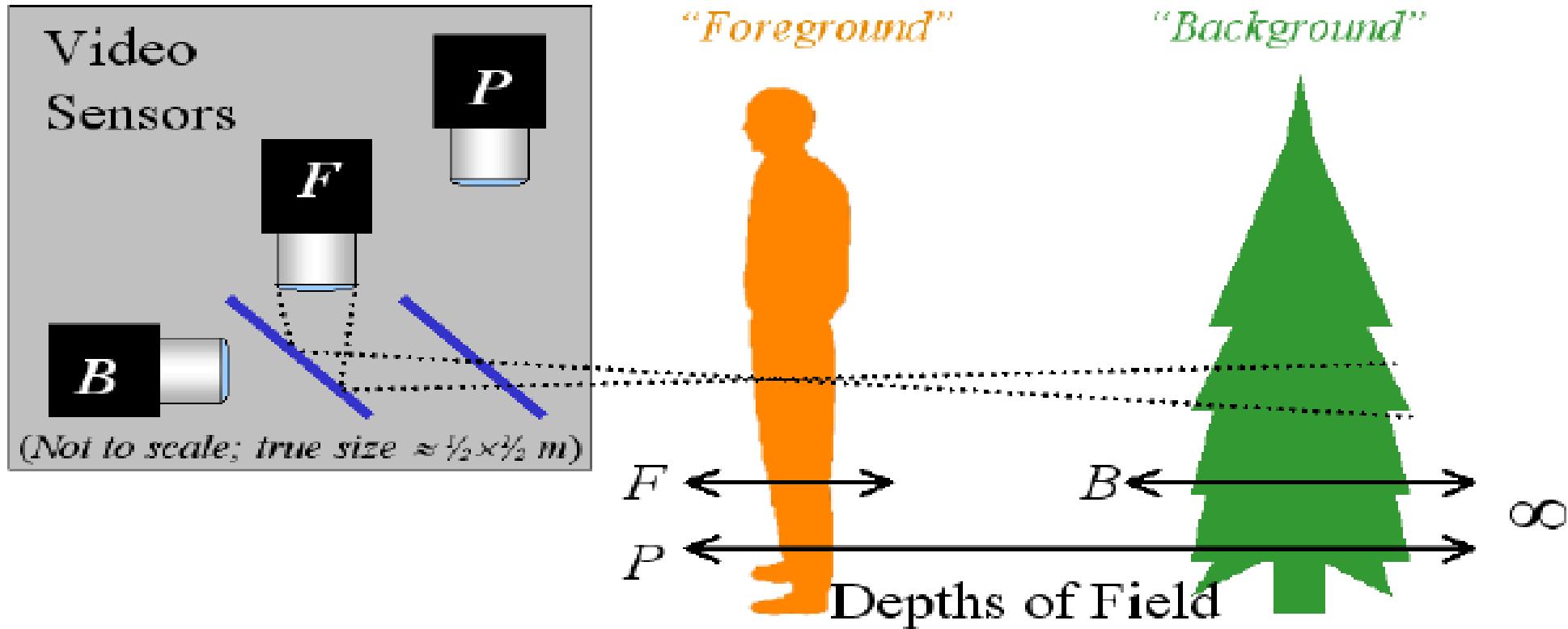


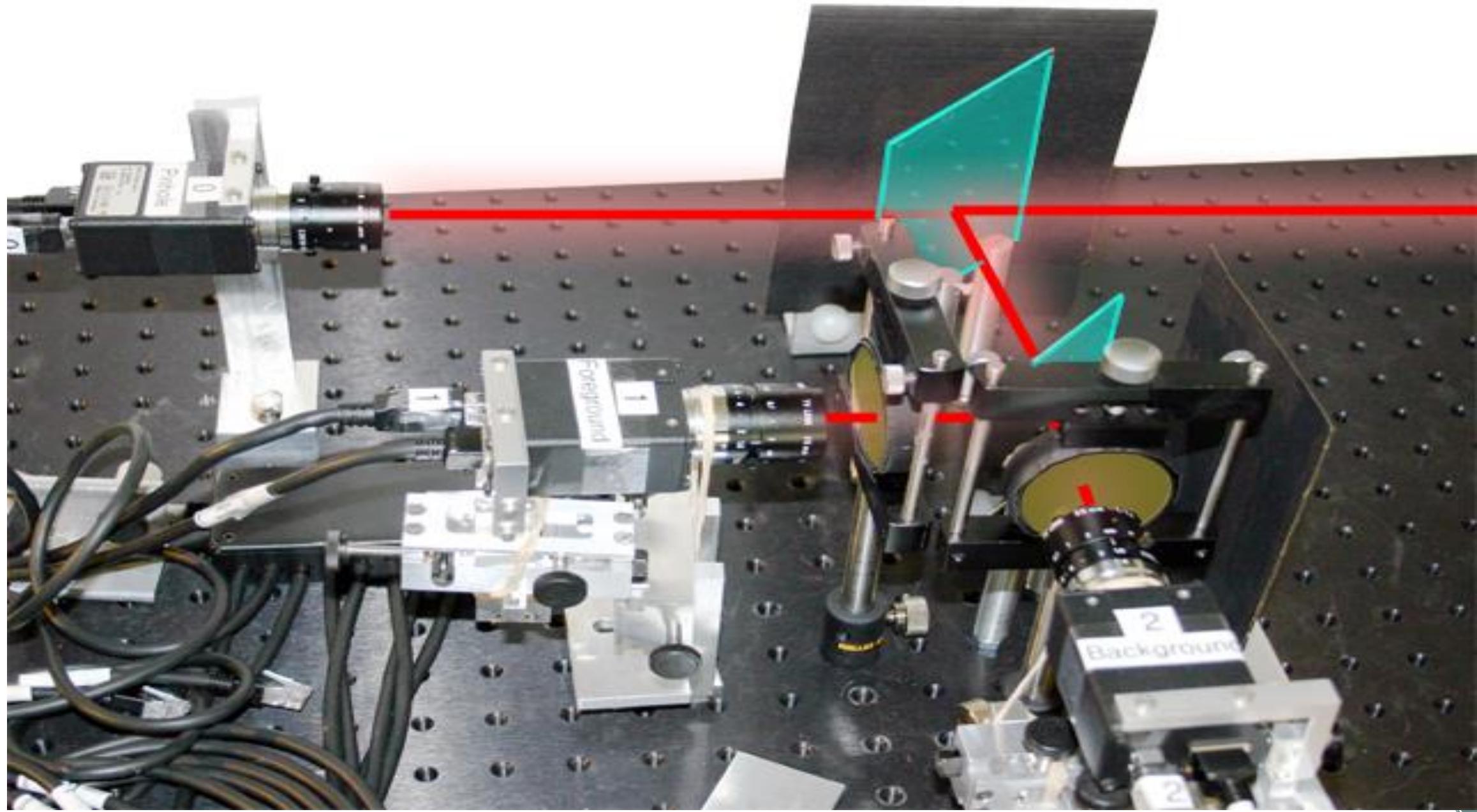
Special hardware/cameras

- Need more than a single camera
- Defocus video matting
- Multiple cameras matting



Defocus video : Capture Hardware





Preview: Input



Everything in Focus

$$I_P$$



Actor in Focus

$$I_F$$



Background in Focus

$$I_B$$

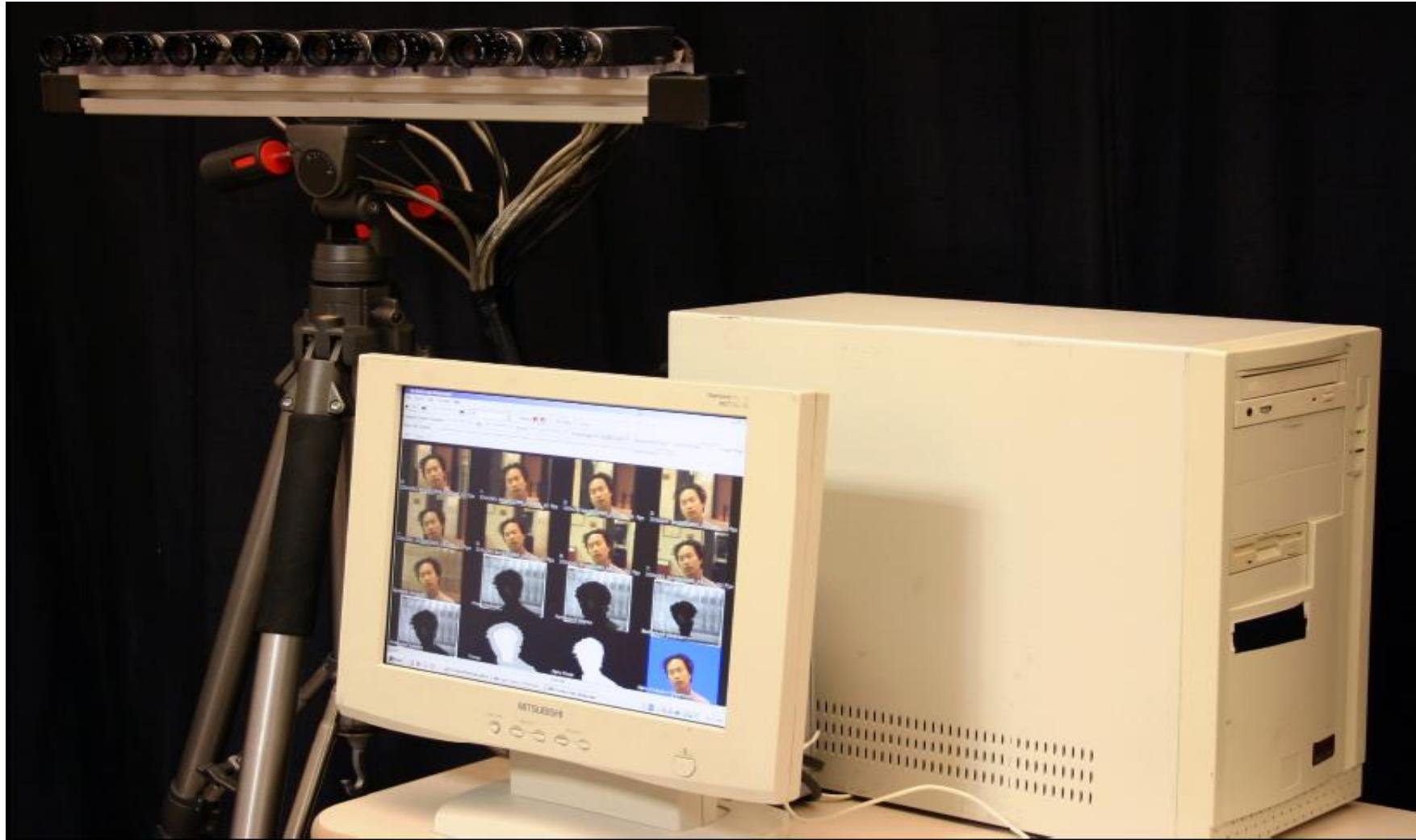


Defocus video

- Show clip DefocusMatting.avi

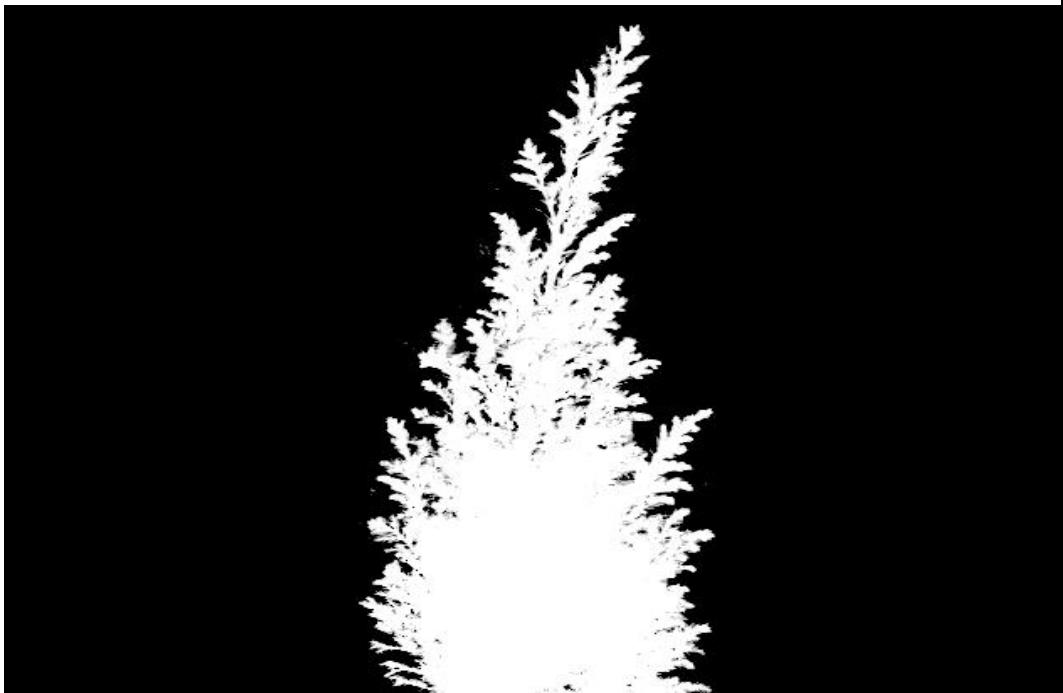
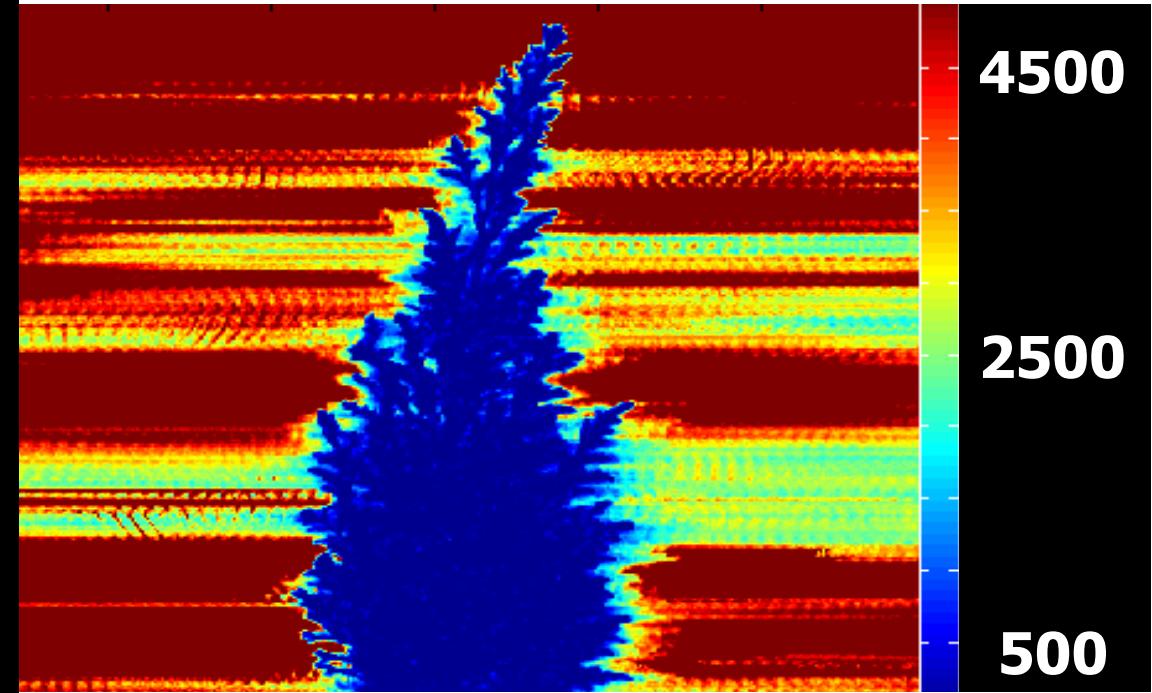


Multi-cameras system



Using a Camera Array







Multi-camera system

- Automatic matte extraction
- Toward real-time performance
- Show clip [CameraArrayMatting.mp4](#)



Variable-Aperture-Based Image Matting



Variable-Aperture Images



f/2



f/2.8



f/4



f/5.6



f/8



f/11



f/16



f/22



Variable-Aperture Images



(a. f/2)



(b. f/2.8)



(c. f/4)



(d. f/5.6)



(e. f/8)



(f. f/11)



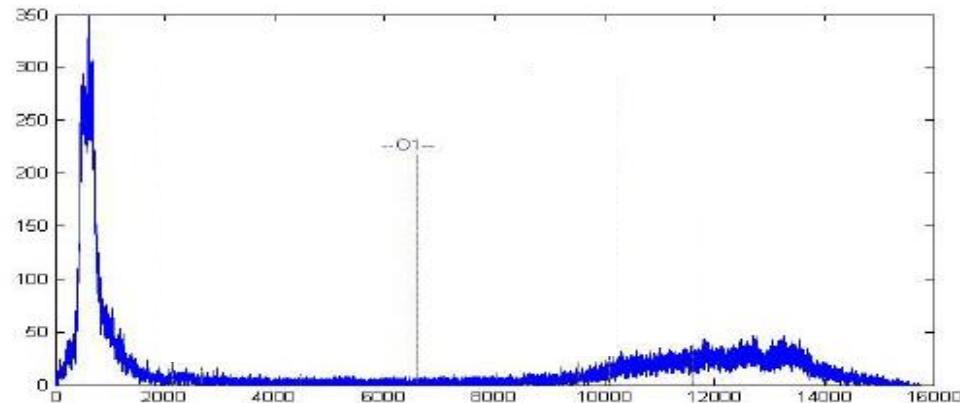
(g. f/16)



(h. f/22)



Trimap Extraction



Experimental Result (cont.)



(b) Our trimap.



(c) Matte from our trimap.



(d) Matte from our trimap.



(e) User trimap.



(f) Matte from user trimap.



(g) Matte from user trimap.



(h) User scribbles.



(i) Matte from user scribbles.



(j) Matte from user scribbles.

■ *Result set: C.*

Closed Form
Matting

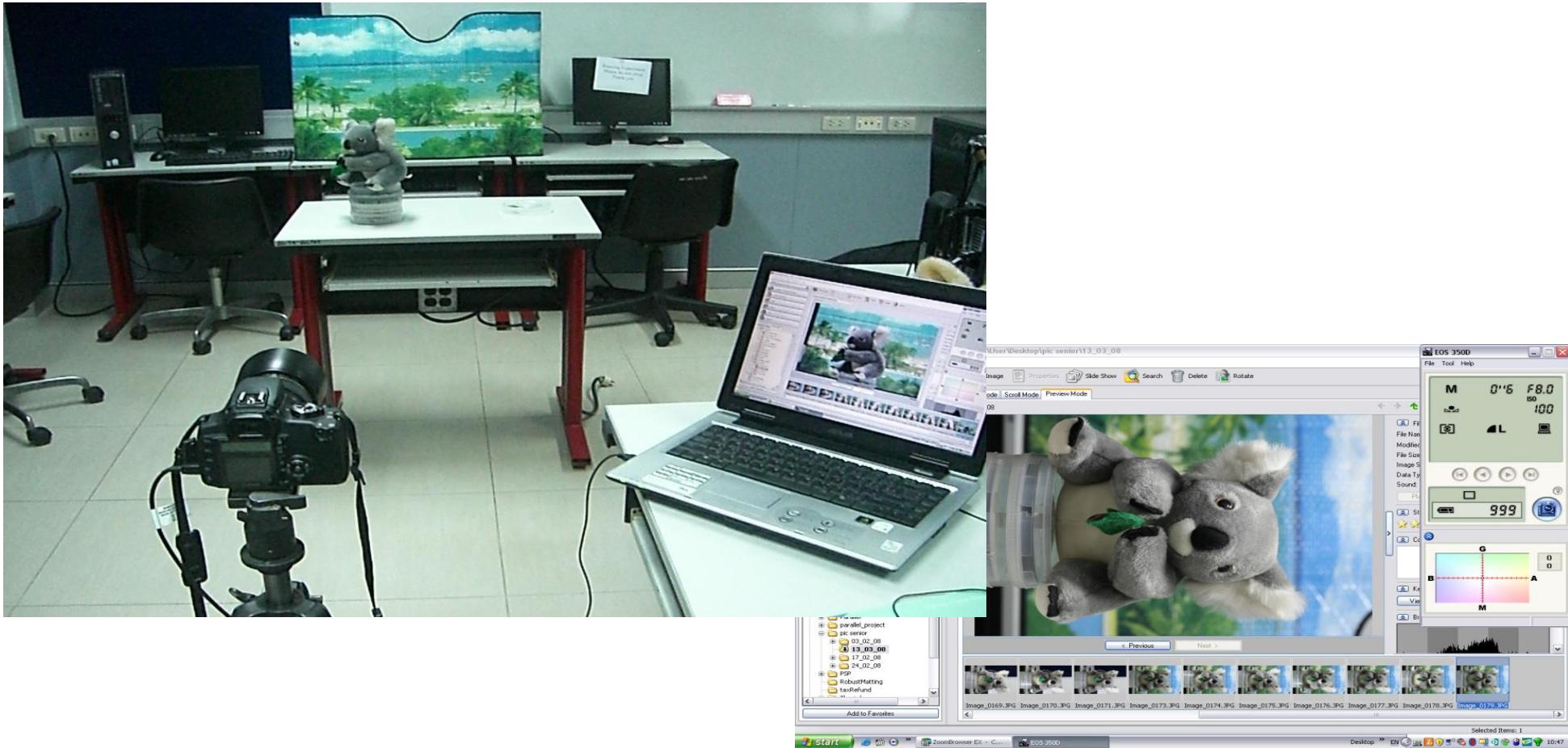
Robust Matting
Matting



Variable-Lighting-Based Image Matting



Data Collection



How to collection dataset (Cont)



Example images under different lighting conditions



Example images under different lighting conditions



Combing Results

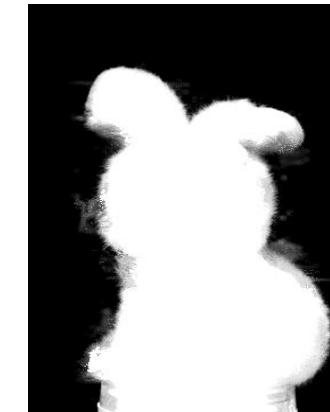
Mean



Median



Mode



Max

Min



Variable-Lighting-Based Image Matting

