Detection of facial expressions and CG animation

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Outline

1. Introduction
2. System Overview
3. Detection of facial expressions
4. Demonstration

Introduction

Computer Animated Films

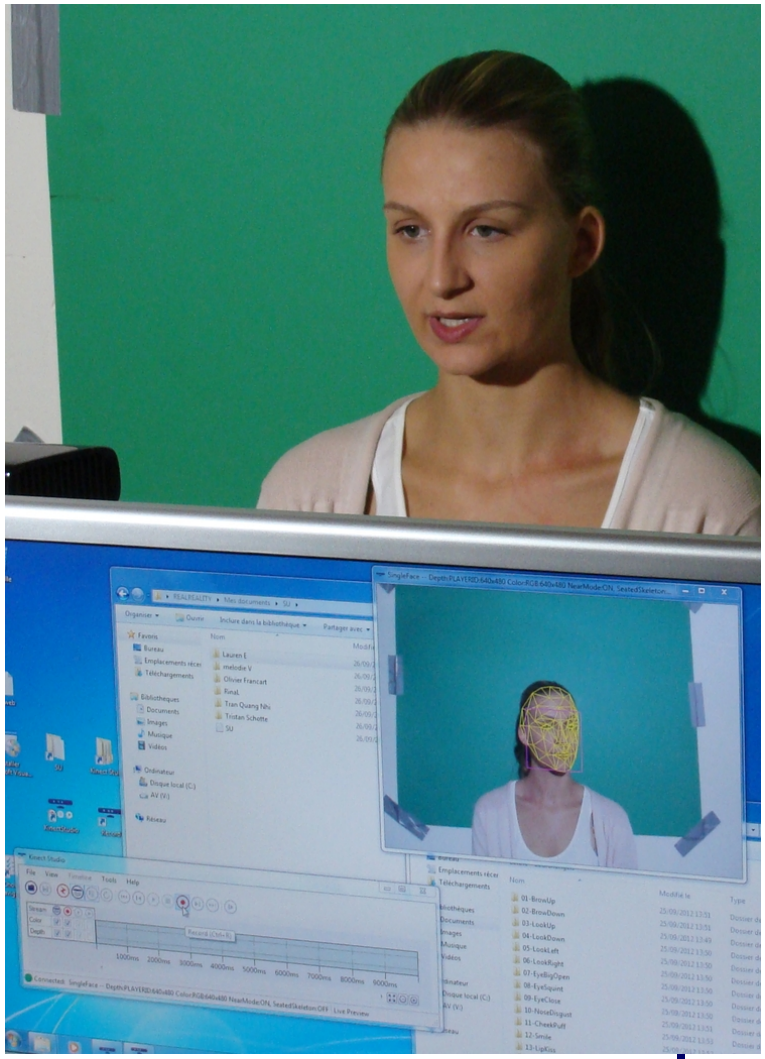
Introduction

Computer Animated Films (Modeling, **Animating**, Rendering)

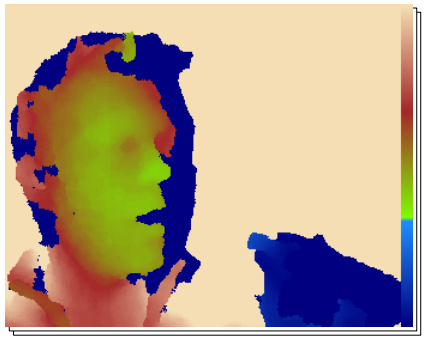
Aim: Semi-Automate Animating facial expressions of CG characters

- Capturing an actor with low cost equipment
- Driving a character by facial actions

Studio setup



Process Overview



Analyze

Level sets of Action Units

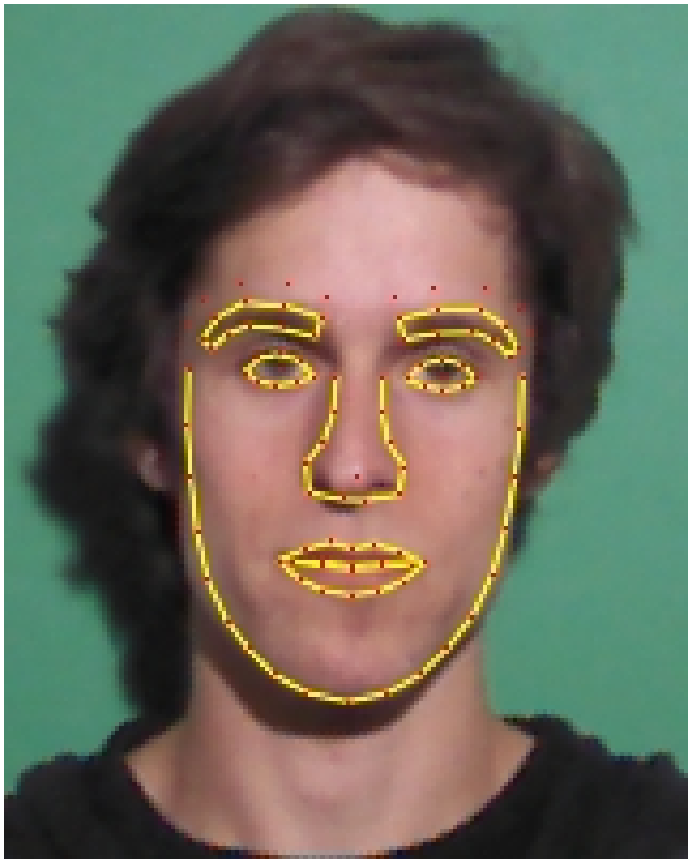
By psychologist Paul Ekman

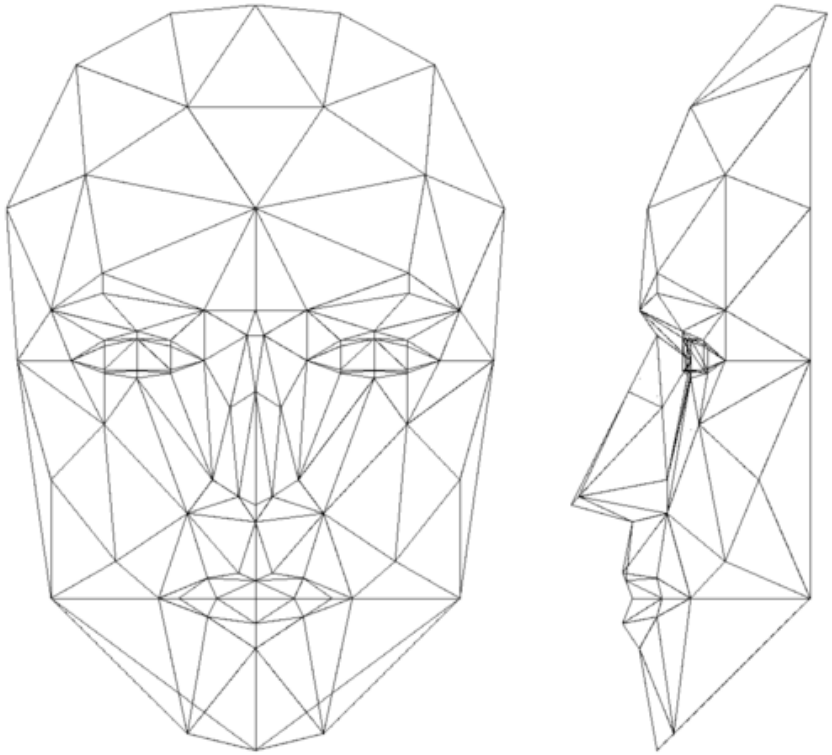
Morph

$$\sum w_i * B_i$$

$$B_i : Base\,Shape$$

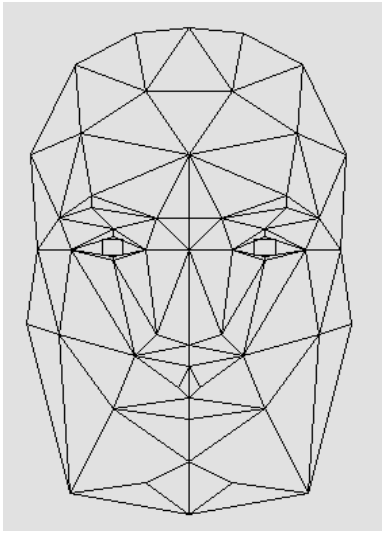
Mesh fitting





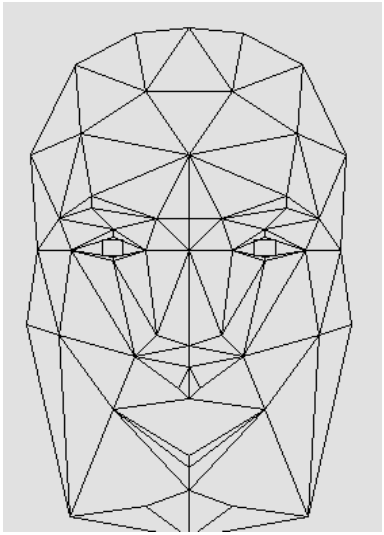
Mesh controlled by AU

- Upper Lip Raiser
- Jaw Lowerer
- Lip Stretcher
- Brow Lowerer
- Lip Corner Depressor
- Outer Brow Raiser



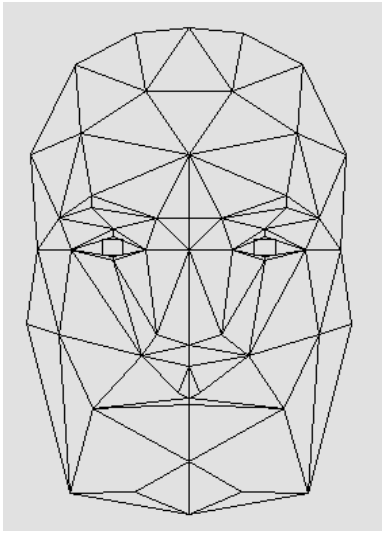
Mesh controlled by AU

- Upper Lip Raiser
- **Jaw Lowerer = 1.0**
- Lip Stretcher
- Brow Lowerer
- Lip Corner Depressor
- Outer Brow Raiser



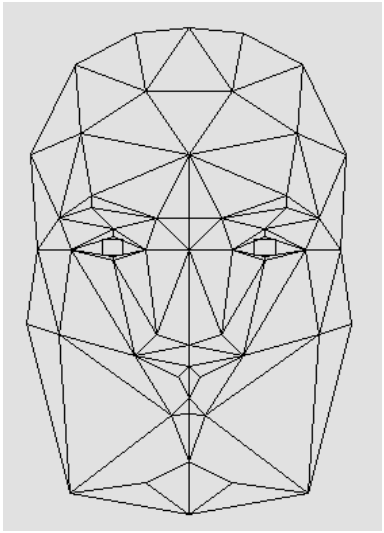
Mesh controlled by AU

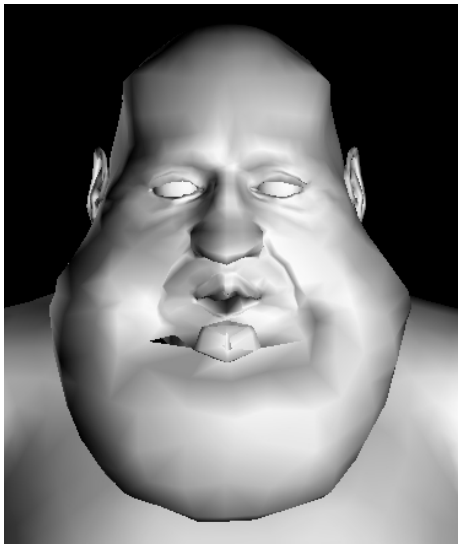
- Upper Lip Raiser
- Jaw Lowerer
- Lip Stretcher = 1.0
- Brow Lowerer
- Lip Corner Depressor
- Outer Brow Raiser



Mesh controlled by AU

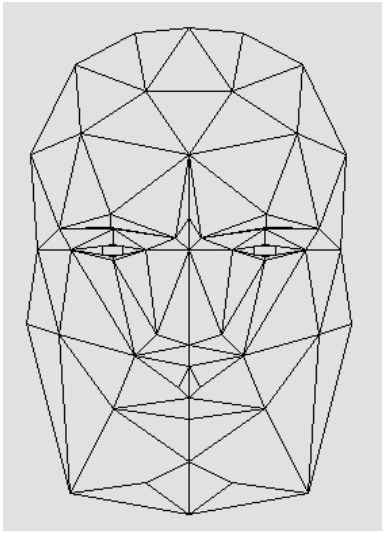
- Upper Lip Raiser
- Jaw Lowerer
- Lip Stretcher = -1.0
- Brow Lowerer
- Lip Corner Depressor
- Outer Brow Raiser





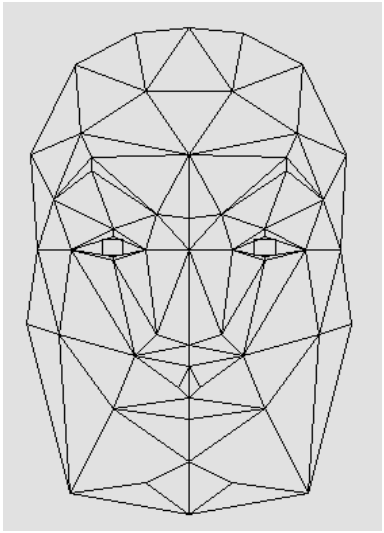
Mesh controlled by AU

- Upper Lip Raiser
- Jaw Lowerer
- Lip Stretcher
- **Brow Lowerer = 1.0**
- Lip Corner Depressor
- Outer Brow Raiser

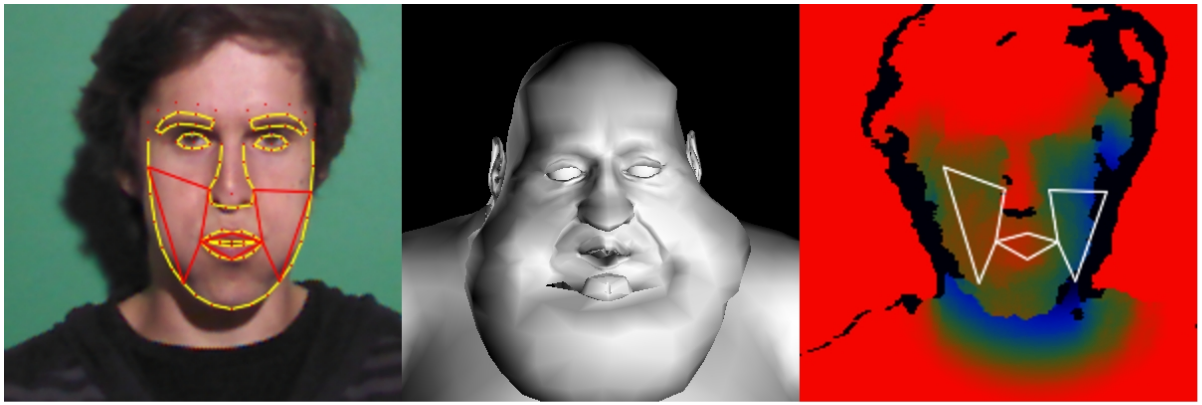


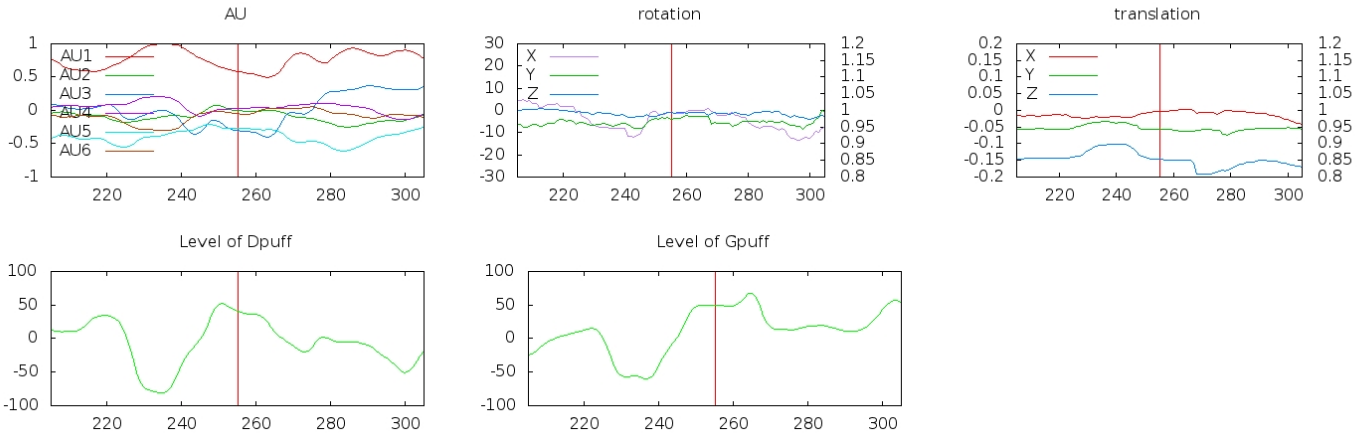
Mesh controlled by AU

- Upper Lip Raiser
- Jaw Lowerer
- Lip Stretcher
- Brow Lowerer
- Lip Corner Depressor
- Outer Brow Raiser = 1.0



Result





Level of puff: Mean distance level from the center of the head

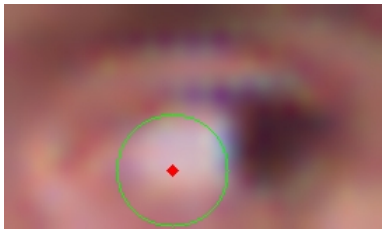
Iris tracking

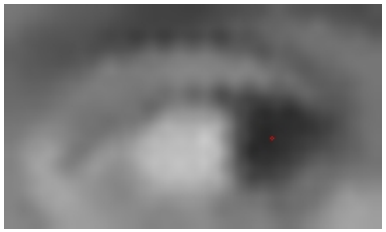
24*11

Circle detection

- Circle Hough transform based on Canny Edge detector
- Integrodifferential operator

$$\max_{(r,\,x_0,\,y_0)} \left| G_\sigma(r) * \frac{\partial}{\partial r} \oint_{r,\,x_0,\,y_0} \frac{I(x,y)}{2\pi r}\, ds \right|$$





Segmentation by graph cuts

1. Eye / Skin
2. Iris / Eye

Daugman, J., High confidence visual recognition of persons by a test of statistical independence, Pattern Analysis and Machine Intelligence, IEEE Transactions on, 1993, Vol. 15(11), pp. 1148-1161

Boykov, Y. & Funka-Lea, G., Graph Cuts and Efficient N-D Image Segmentation, International Journal of Computer Vision, Kluwer Academic Publishers, 2006, Vol. 70(2), pp. 109-131

Demo