

# Recent Research Summary (2004-2008)

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## Contents (2004-2008)

- ❖ Photorealistic rendering of landscape
- ❖ GPU-based volume visualization
- ❖ Stroke-based accurate ROI extraction
- ❖ Domain-driven visual analytics
- ❖ Example-based illustration

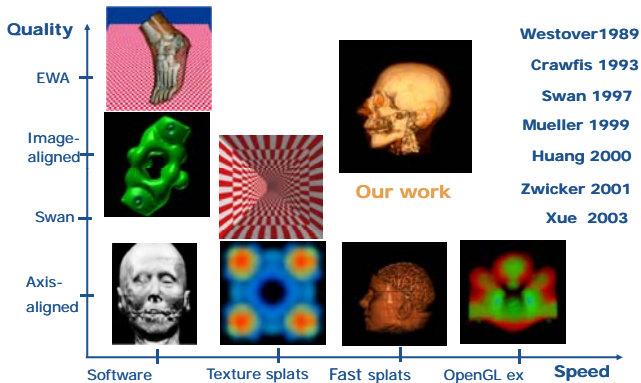
## Large-scale landscape simulation



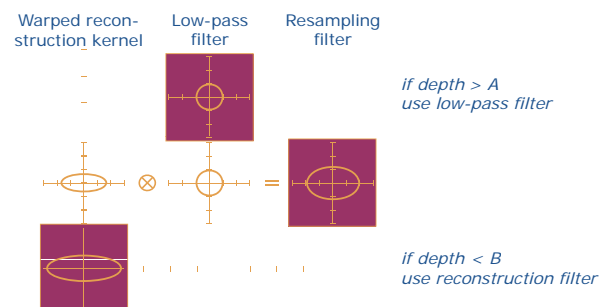
## Wetland of West Lake, Hangzhou



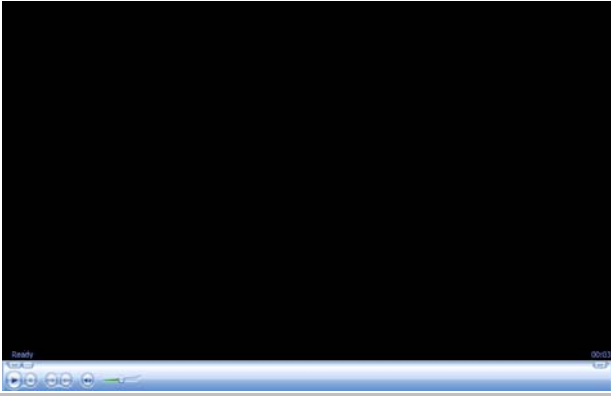
## Hardware-Accelerated Adaptive EWA Splatting



## Framework for point and volume splatting

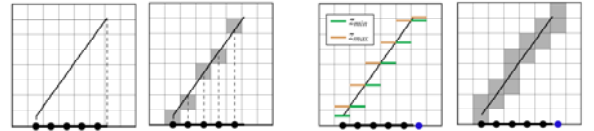


## Hardware-Accelerated Adaptive EWA Splatting



## Conservative Voxelization

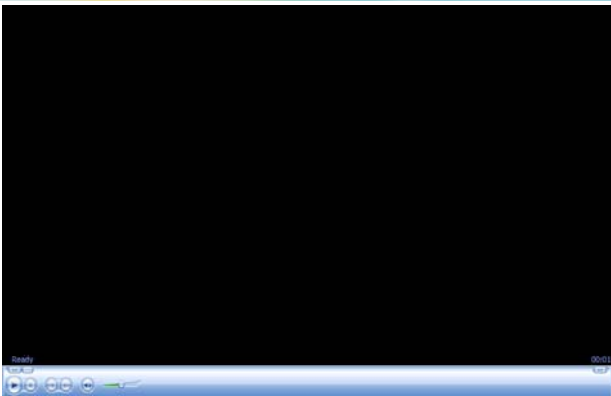
❖ **Conservative correctness: all voxels intersecting the input model are recognized.**



Previous approach: generate a single voxel for each pixel by using the depth in the pixel center

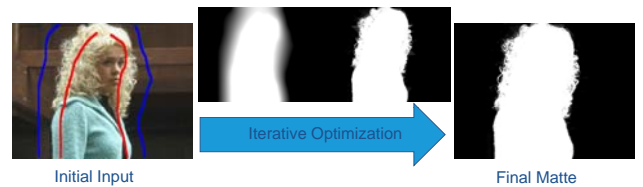
Our approach: generate multiple voxels for each pixel by computing the depth range in the pixel

## Conservative Voxelization

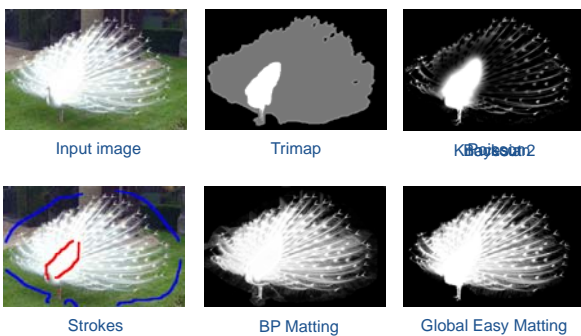


## Easy Image Matting

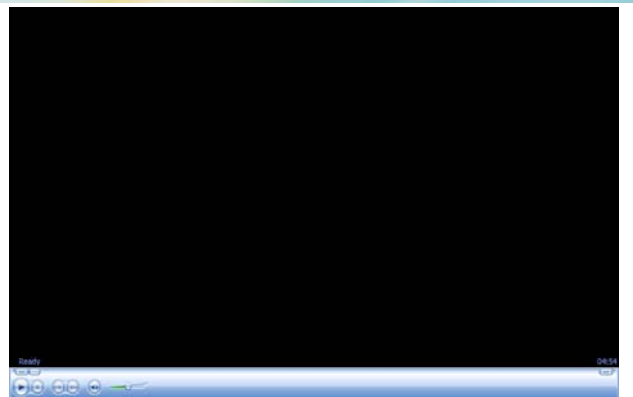
- ❖ **User draws strokes on image**
- ❖ **Known propagates to unknown**
- ❖ **Two lineally solvable energy items**
- ❖ **Local refinement**



## Results

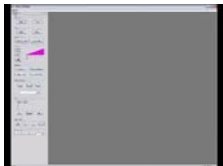


## Video Demo

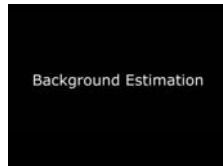


## Interactive Space-Time Video Matting

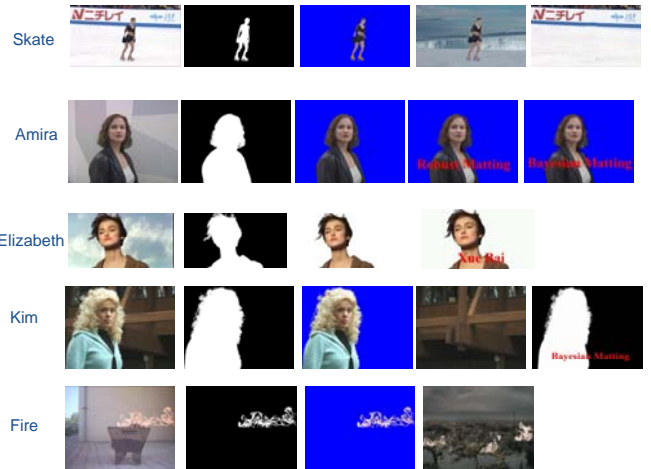
- ❖ User draws strokes on video cube
- ❖ A new volume expansion scheme
- ❖ Extract the matte and foreground over the 3D video volume by optimization



Interactive Demo



Background estimation

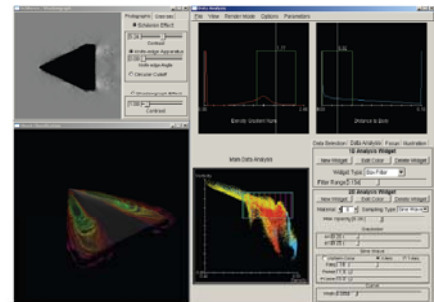


## Easy Mesh Matting

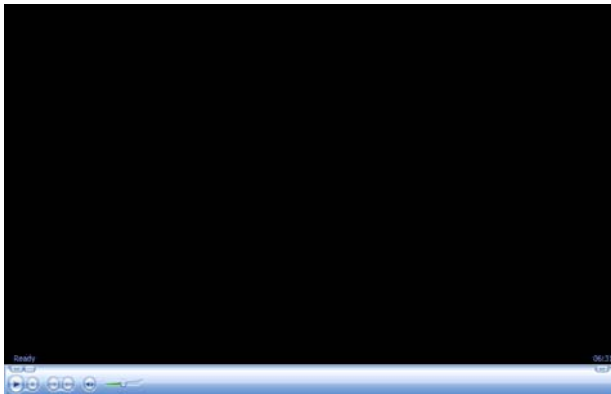
- ❖ User draws strokes on mesh
- ❖ Works for overlaying surface or fuzzy boundary



## Visual Analytics for flow features on unstructured grids

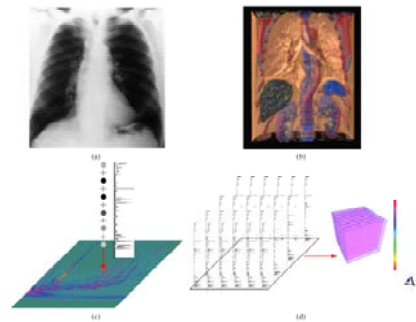


## Visual Analytics for flow features on unstructured grids

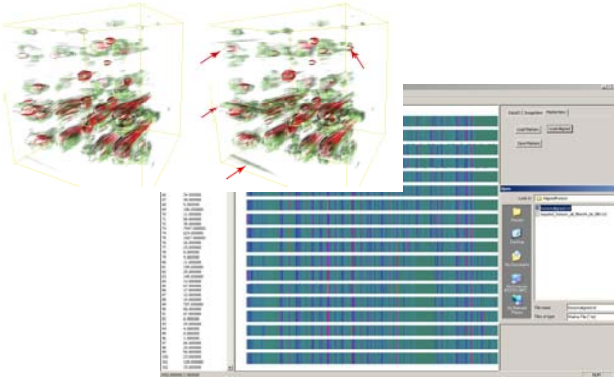


## Visual Analytics of GCxGC-TOF for cancer detection

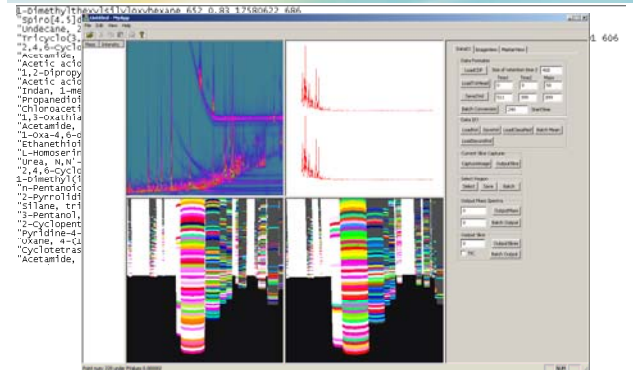
- OMICS: Genomics: SNP; Lipidomics: 1D; Proteomics: MS (2D)  
Metabolomics: GCxGC MS / NMR (2D)



## 2D/3D comparative visualization



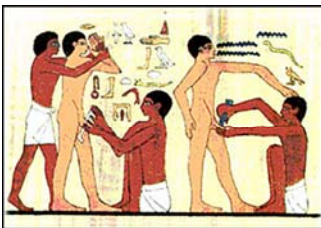
## Comparative visualization and exploration of potential bio-markers



Live demo

## Motivation

### ❖ Illustration is a visual representation



## Example-based Illustration

### ❖ Learn from examples for case that are difficult to represent and model

- Existing 2D illustrations
- Existing models and datasets

### ❖ Fulfill example-based illustration by means of

- Shape deformation
- Texture synthesis

## Overview

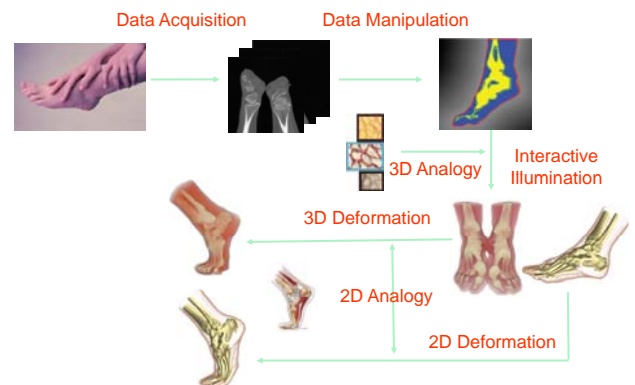
### ❖ Shape and shape variations by examples

- Convey objects from measured datasets
- Interactive shape manipulation
- Example-based shape transfer

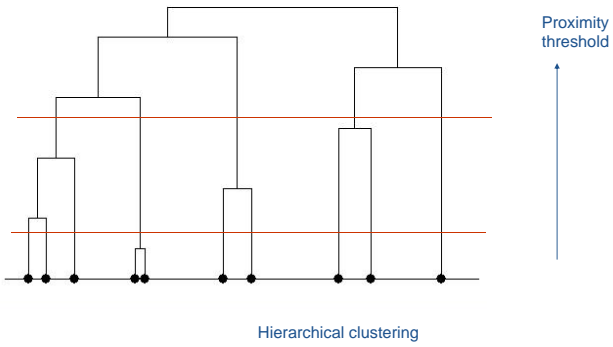
### ❖ Appearance and rendering styles by examples

- Texture synthesis and transfer
- Rendering styles by examples

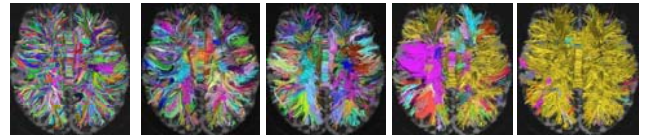
## Computer-generated illustration



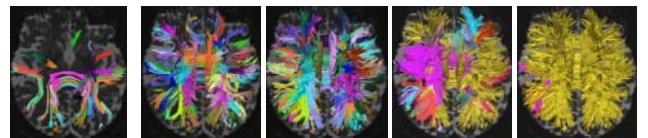
## DTI-based Fiber Illustration



## Parameter Setting



proximity threshold = 1.5 mm    2.5 mm    3.5 mm    4.5 mm    5.5 mm



cluster size > 10

## Smoothed geometric hulls



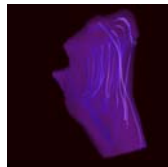
A fiber cluster



Alpha shape

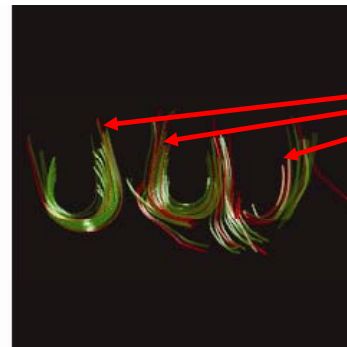


After smoothing



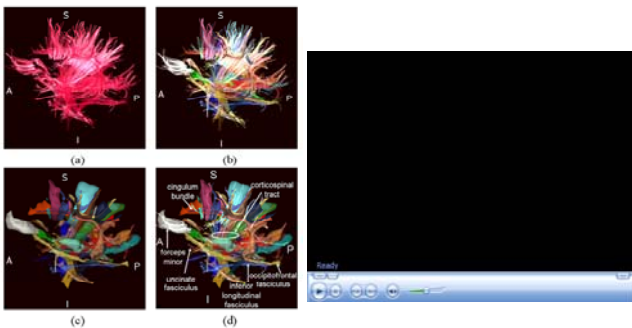
Fiber cluster + smoothed alpha shape

## Principal fibers

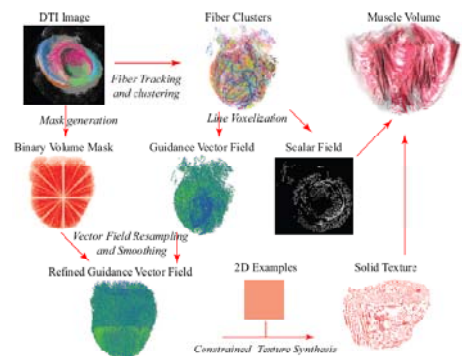


Several principal fibers

## Abstractive Exploration of Hierarchical Fibers



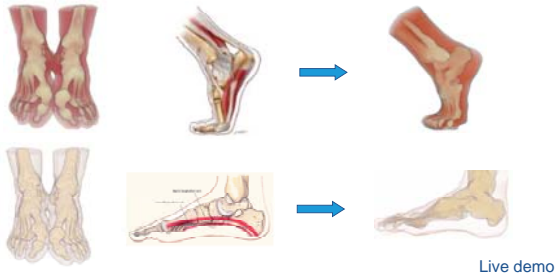
## DTI-based Muscle Illustration



## Example based shape transfer

### ❖ 2D to 3D

- Using curve to drive deformation



## Example based shape transfer

### ❖ 2D to 3D

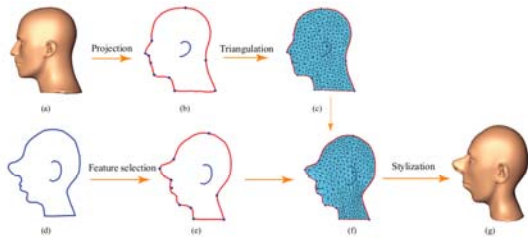
- Using distance field to convert surface to data to get smooth boundary effects



## Example based shape transfer

### ❖ 3D stylization from 2D example

- Context curves, silhouette, feature points, local geometric details

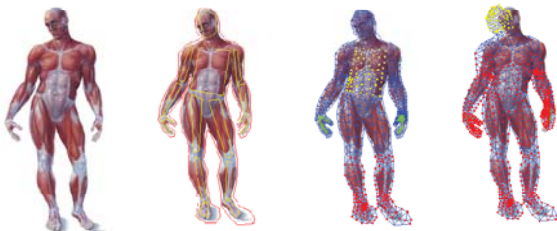


Video demo

## Example based shape transfer

### ❖ 2D deformation by example

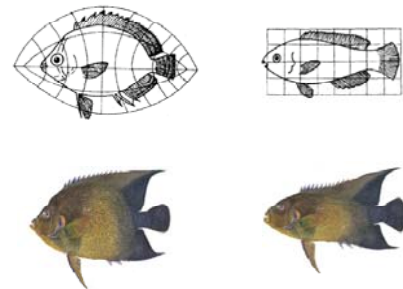
- Differential based 2D mesh manipulation



## Example based shape transfer

### ❖ 2D deformation by example

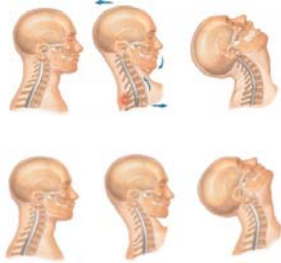
- Example-based shape manipulation



## Example based shape transfer

### ❖ 2D deformation by examples

- Flexible post-process to modify the results

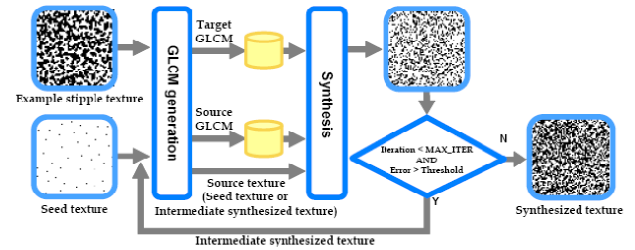


Video demo

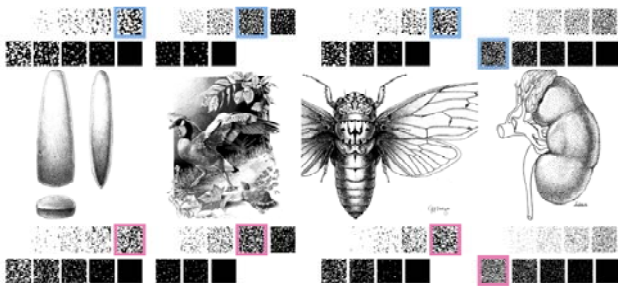
## Stippling by examples

### ❖ Image space stippling by examples

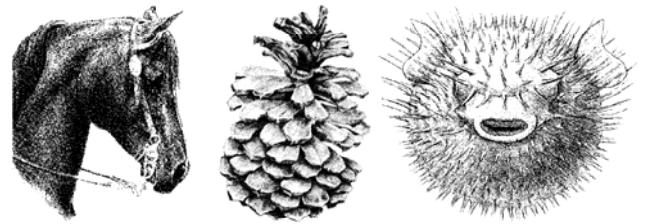
- GLCM (gray-level co-occurrence matrix)



## Stippling by examples



## Stippling by examples



## Acknowledgments

### ❖ Collaborators:

- David S. Ebert, Qunsheng Peng, Song Zhang, Stefan Correria, Aidong Lu, Dan Raftery, Ligang Liu, Xiao Liang, Yu Guan, Zi'ang Ding, Colin Zheng, Long Zhang, Colin Zheng, Yuyang Song, Kelly Gaitner, Hanspeter Pfister, Liu Ren, Mattias Zwicker, Zhao Dong, Hujun Bao

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# Thank You !

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