

Computer Vision Systems Programming VO

Computer Vision: Past, Present, Future

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Topics

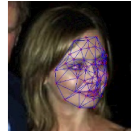
Selection of past, present, future CV applications

More detailed coverage in upcoming lectures

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Images from LeCun et al. 1989, Shotton et al. 2011, Taiman et al. 2013

What is CV?

Make computers understand images and videos

- ▶ Different levels of understanding

CV is hard

- ▶ Inverse (ill-posed) problem

Still, CV has been successfully used in a variety of applications

- ▶ This lecture introduces a few in chronological order

1963: Pose Estimation

Edge-based pose estimation of polyhedra

Among first CV applications

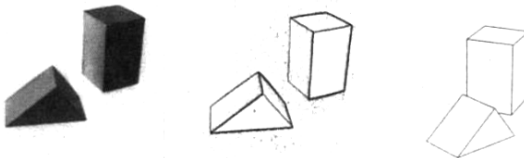


Image from Roberts 1963

1973: Part-Based Object Detection

Object representation as parts connected by springs
Known as pictorial structures or constellation models

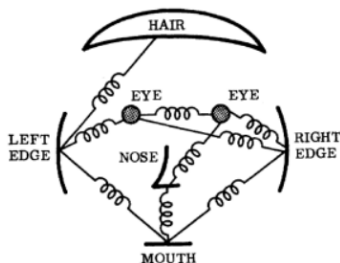
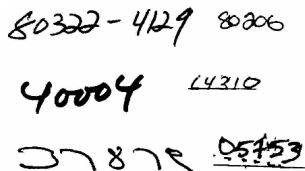


Image from Fischler and Elschlager 1973

1989: OCR via Deep Learning

Zip code recognition from images

Among first applications using deep convolutional neural networks



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Image from LeCun et al. 1989

1989: OCR via Deep Learning

Network Architecture

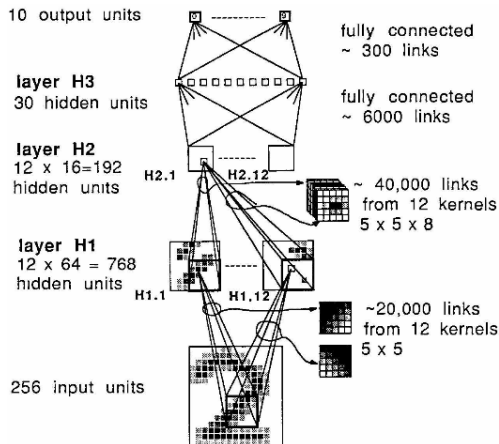


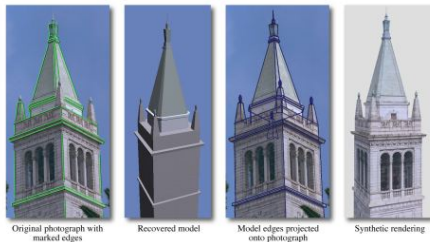
Image from LeCun et al. 1989

1996: Image-Based Modeling

Generate a 3D model from a set of images

Use this model and input images to render new images

https://www.youtube.com/watch?v=RPhGEiM_6lM



Images from Debevec 1996

2006: Photo Tourism

3D reconstruction from photo collections

Structure from Motion (SIFT + bundle adjustment)



Images from Snavely, Seitz, and Szeliski 2006

2006: Photo Tourism

Microsoft Photosynth

<https://photosynth.net>

2006: Photo Tourism

Building Rome in a Day

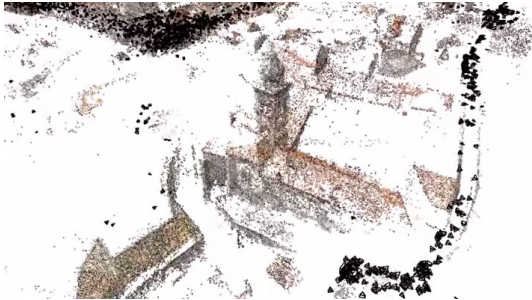


Image from <https://www.youtube.com/watch?v=sQegEro58fo>

2007: Smart Digital Cameras

Cameras with face auto focus

Technology similar to Viola and Jones 2001



Image from olympus-europa.com

2011: Kinect

Depth estimation via active stereo

Real-time pose estimation of multiple players



Image from wikipedia.org



Image from Shotton et al. 2011

2013: Human-Level Face Verification

Face verification using a deep convolutional neural network

3D face modeling and frontalization

Verification performance comparable to humans

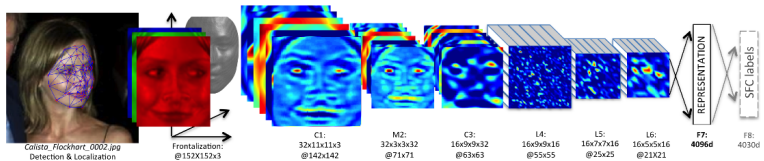


Image from Taigman et al. 2013

20xx: Human-Level Object Recognition

Object recognition without constraints

Hot research topic (<http://image-net.org/challenges/LSVRC/2014/index>)

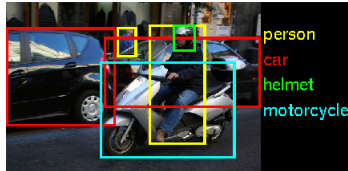


Image from image-net.org

20xx: Autonomous Cars

Cars that drive autonomously

Major research area (e.g. Google)

- ▶ <https://www.youtube.com/watch?v=bD0nn0-4Nq8>



Image by Google

20xx: Human-Level Scene Understanding

Object recognition and segmentation, motion, context

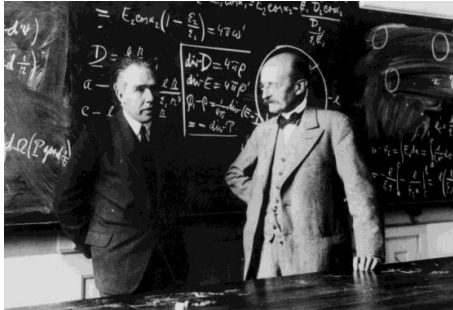


Image from Larry Zitnick's slides

Bibliography I

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