

# **Fundamentals of Multimedia**

## **Introduction to Multimedia**



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# Outline

- **1.1 The Outline**
- **1.2 History of Multimedia**
- **1.3 Typical Multimedia Software System**

# 1.1 Outline: What is Multimedia ... ?

- The meaning of “Multimedia” ?

Many quite different, even opposing viewpoints:

- A PC Vendor
- A Consumer Entertainment vendor
- A Computer Science Student

# 1.1 Outline: What is Multimedia ... ?

## PC Vendor

- Audio Function
- DVD-ROM Driver
- Multimedia Processor...



Video Card



3D Display card



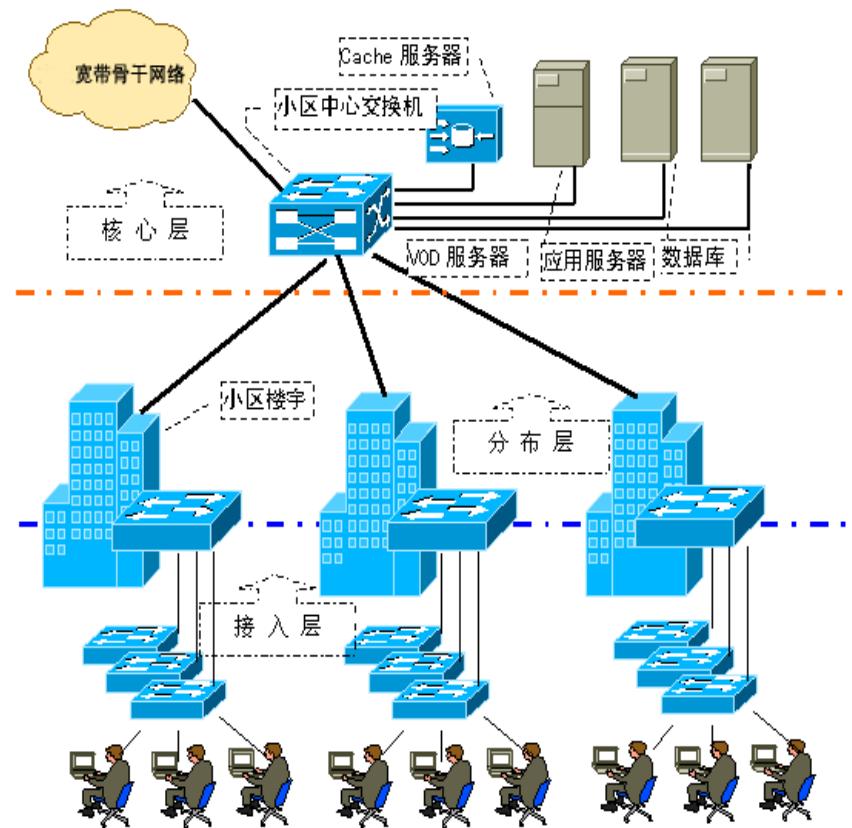
Audio Card



# 1.1 Outline: What is Multimedia ... ?

## A Consumer Entertainment Vendor

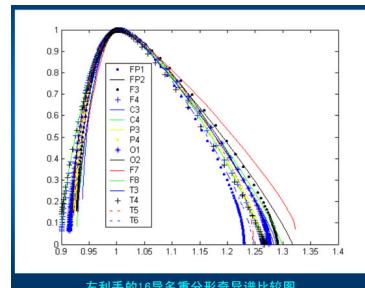
- Interactive cable TV
- Service over High-speed internet



# 1.1 Outline: What is Multimedia ... ?

## A Computer Science Student

- About Multiple Modality information application:
- Text, Image, Graphics, Animation ,Video, Sound...



# 1.1 Outline: One typical definition

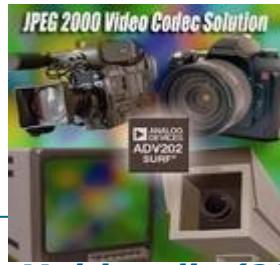
- **Multimedia definition:** The Technology to Collect, Process, Edit, Store and Present **more than two medias at the same time**
  - Including text, image, graphics, animation and moving pictures.
- **A more general definition:** The independent machine which is able to create, represent, process, store, retrieve the **information in various medias**



# 1.1 Outline: Category of medias by CCITT

- Perception Medium : Directly make human have the feeling to the media
  - Including human's speech, music and various sound from natural environment, the moving image, graphics, curve, animation and text.
- Representation Medium : The middle method to transfer to feeling, to effectively transfer from one place to another
  - Including various audio encode, music encode, image encode, text encode, moving picture encode and still picture encode.

CCITT : International Telegraph and Telephone Consultative Committee



# 1.1 Outline: Category of medias by CCITT

- Presentation Medium : conversion between electronic signal and feeling medias
- Two kinds :
  - Input medium (including keyboard, mouse, camera, Scanner, light pen, micro-phone)
  - And output medium (including display, printer, drawer)



# 1.1 Outline: Category of medias by CCITT

- Storage Medium: storing the medias, in order to access the medias in local or remote place as needed
  - Hard disk, floppy disk, CD, tape,...



Transmission Medium: Transmission of the media from one place to another.

- Telephone line, Twisted line, cable, fiber, radio, ...

# 1.1 Outline: Multimedia application

- Education



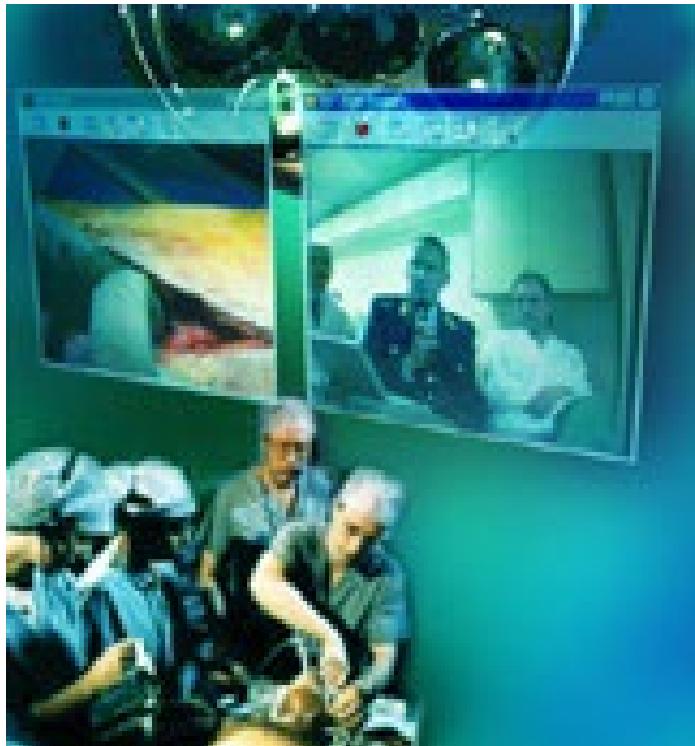
Video teleconferencing



Distributed Lectures for Higher Education

# 1.1 Outline: Multimedia Application

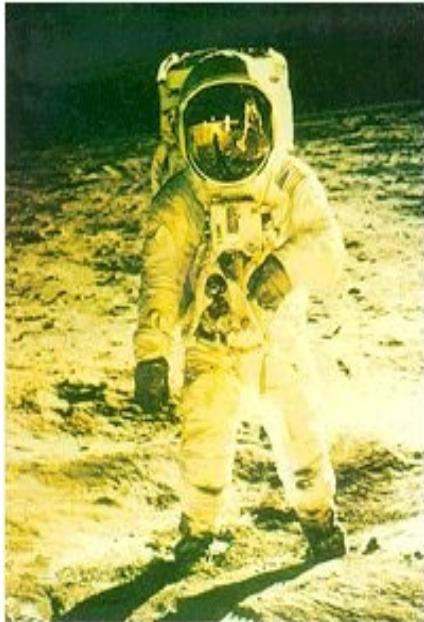
- Medicine



Telemedicine

# 1.1 Outline: Multimedia Application

- Spaceflight



Armstrong on the moon



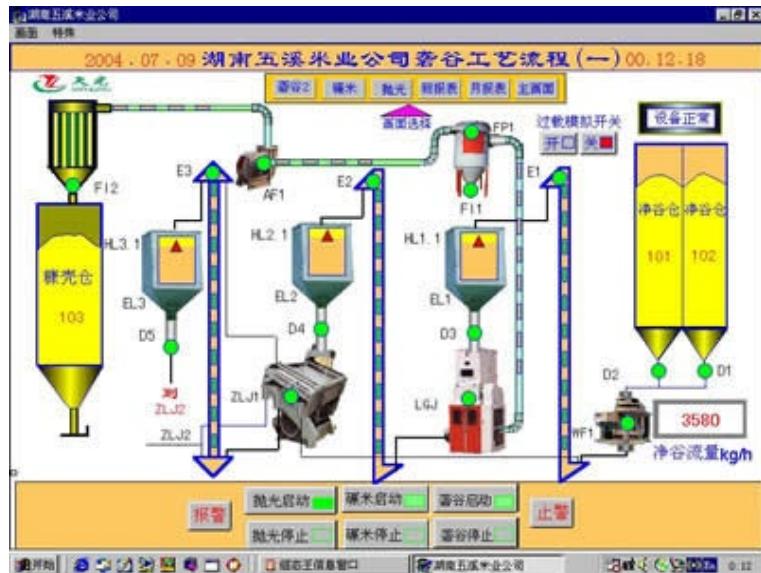
Shenzhou No. 7



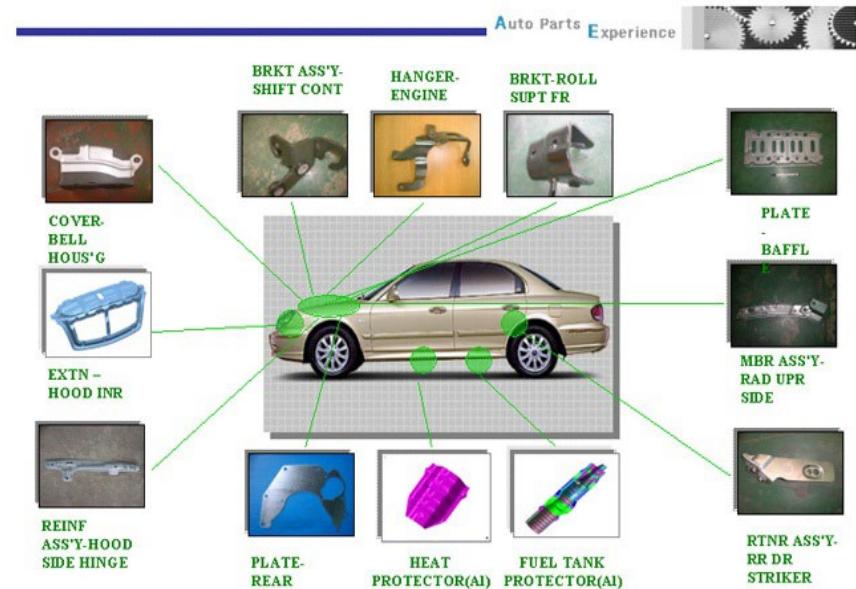
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# 1.1 Outline: Multimedia Application

- Industry manufacture automation



Manufacture Automatic Monitor system



Automobile Model Design

# 1.1 Outline: Multimedia Application

- Culture heritage preservation and Tourism



Augmented Reality



<http://www.edushi.com/>

# 1.1 Outline: Multimedia Application

Culture heritage preservation



Dunhuang Mural

# 1.1 Outline: Multimedia application

- Game and Entertainment



Cooperative work environments

## 1.1 Outline: Multimedia VS. Computer Science

- More and more computer fields relevant to multimedia
  - Operation System
  - Networks
  - Vision Process
  - Information Retrieval
  - Real-time Systems...

# 1.2 History : Beginning of the idea

- **Newspaper**: start of communication with media
  - The first Public Media
  - Using text, graph and table
- **Film without sound**: 1910-1927, ended by the Jazz Singer
  - Jazz Singer (Music film), the first film with sound
  - Thomas A. Edison invented the moving camera in 1887



# 1.2 History : Beginning of the idea

- Radio: became the main media of broadcasting
  - Guglielmo Marconi (Italy)
  - Transmit radio signal in 1895, won Nobel Physics prize in Nov. 1909
- TV: The innovative media in 20th century
  - Changed the public communication all over the world

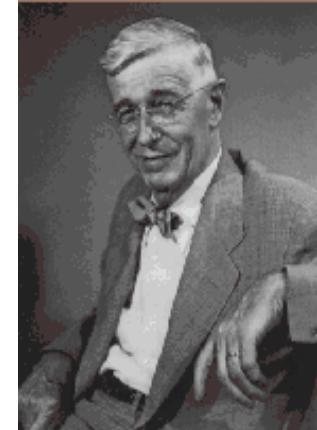


马可尼, G.

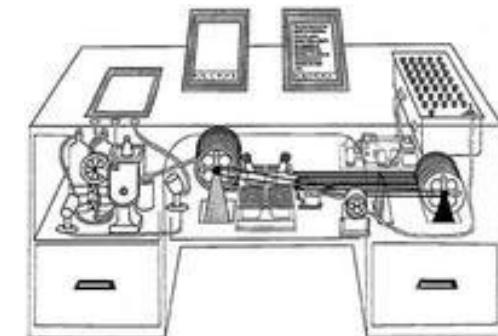


# 1.2 History: Initial technology

- 1945 **Vannevar Bush**: propose one **Hypermedia System** relevant concept -- “Memex”
  - <http://www.cs.sfu.ca/CC/365/mark/material/no tes/Chap1/VBushArticle/>
- 1960s **Ted Nelson started Xanadu project**, The first test to develop **Hypertext System**
  - [http://www.wiki.cn/wiki/Project\\_Xanadu](http://www.wiki.cn/wiki/Project_Xanadu)
  - **Ted Nelson, American sociologist, philosopher, Forerunner of information technology,**
  - **Put forward “hypertext” 1n 1963**



Vannevar Bush



Memex

# 1.2 History: Initial technology

- 1968 **Douglas Engelbart**, showed another hypertext system -- “On-Line System” (NLS)
  - **Douglas Engelbart, 32th touring prize (1997年 ) winner , the inventor of computer Mouse**

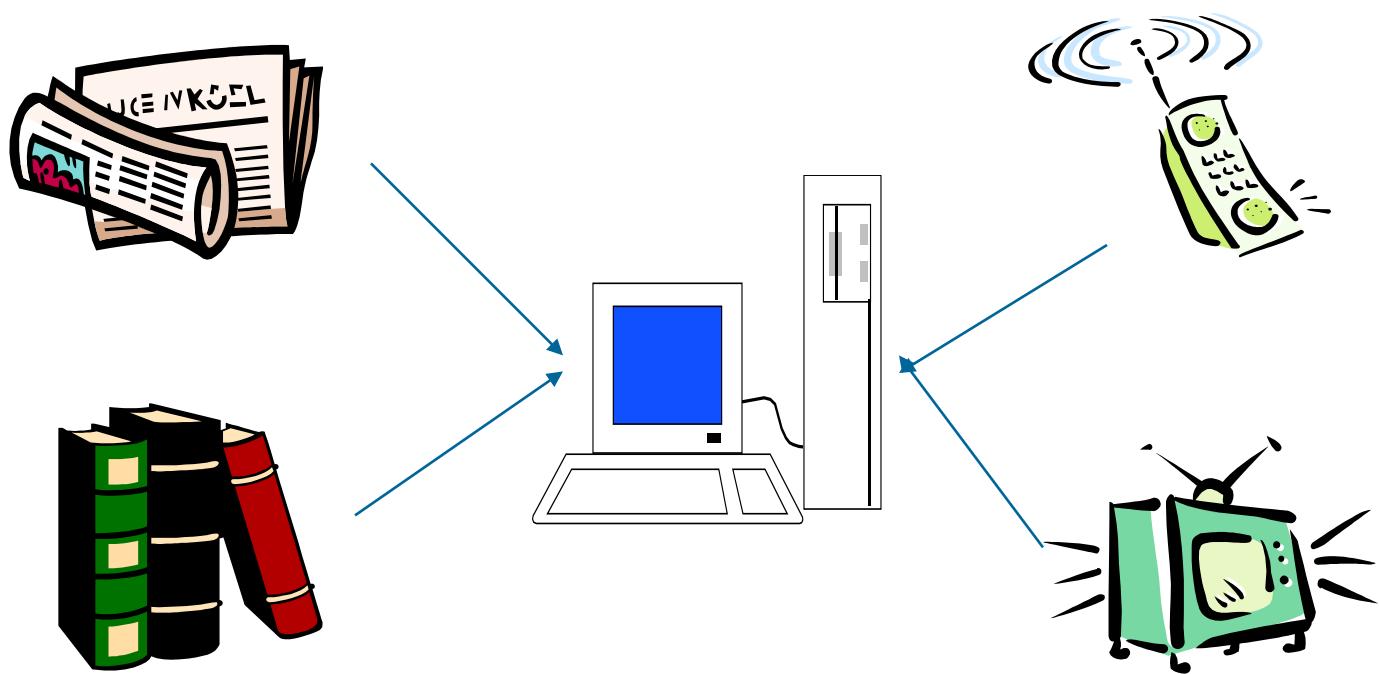


世界上第一个鼠标

- **Some important idea**: hyperlink, teleconference, text processing, email, window software, help system

# 1.2 History: Technology birth

- 80's 20th century: Input sound, image, graphics into computer as **new information carriers**, process and output
  - Make computer application more wider, easier to use
  - Multimedia idea develops rapidly

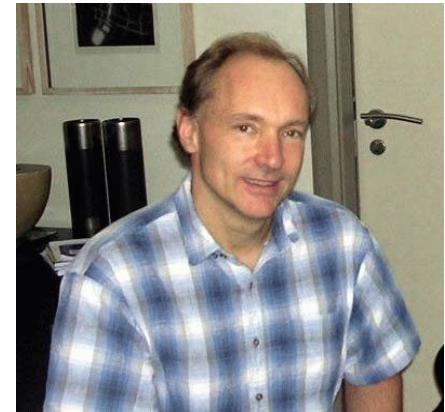


## 1.2 History: Technology birth

- 1976, MIT proposed “Multiple Media” proposal to DARPA
- 1984, Apple developed Macintosh system with Bitmap, Window and Icon: GUI
- 1985, Microsoft Windows
- 1985, the first multimedia system “Amiga” was developed by Commodore

# 1.2 History: Technology growing up

- 1985-Negroponte and Wiesner set up the MIT Media Lab
  - World First-level digital video and multimedia research institute
- 1989-Tim Berners-Lee suggested World Wide Web to cern
  - Berners-Lee, the father of “WWW”,
  - Now leading the non-profit organization W3C.



**Tim Berners-Lee**

- 1990-Kristina Hooper Woolsey set up Apple Multimedia Lab with 100 persons

# 1.2 History: Technology Mature

- 1991-MPEG-1 adopted as International digital video standard
  - In 1990s, MPEG-2, MPEG4 and other MPEG-X were proposed
- 1992-JPEG was adopted as international digital image standard
  - Improved to JPEG2000;
- The same year, the MBone appeared
  - MBone (Multicast Backbone) was a virtual network set up for Internet engineering task group's (IETF) video conference
  - It shares the same physical media with Internet, supporting audio, video and whiteboard
  - <http://www.hudong.com/wiki/MBONE>

## 1.2 History: Technology Mature

- 1993: Illinois University proposed the NCSA Mosaic
  - NCSA Mosaic (TM) was developed by Illinois university National Center of Super computing Application (NCSA)
  - X-Windows based Browser, the ancestors of MS IE, Netscape as well other web browser



- 1994: Jim Clark and Marc Andresen developed the WWW browser Netscape
  - Netscape had ever been in the leading position in web browser fields and was defeated by Internet Explorer of Microsoft
  - By Nov. 1998, Netscape was purchased by AOL

## 1.2 History: Technology Development

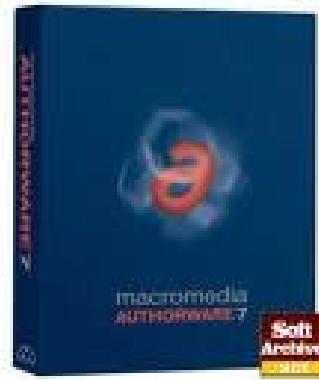
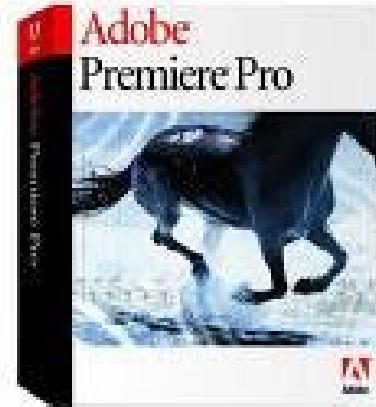
- 1995, JAVA was created
- 1996, DVD video was introduced
- 1998, XML1.0 was announced as a W3C Recommendation
- 1998, handheld MP3 devices first made inroads into consumer
- 2000, WWW size was estimated at over 1 billion pages
- 2001, Wikipedia was created , a free and open encyclopedia cooperative plan. Now it has become the greatest network encyclopedia over the world
- 2001, MPEG7 was formulated
- 2005, Part13 of MPEG-21 was formulated and SVC (scalable video coding) was announced
- .....

# 1.2 History: Technology Research

- Multimedia processing and coding
  - Multimedia content analysis
  - Content-based multimedia retrieval
  - Multimedia security
  - Audio\image\video processing, compression, and so on
- Multimedia system support and networking
  - Network Protocols, internet, operating systems
  - Server and clients, quality of service (QoS) and Databases

# 1.2 History: Technology Research

- Tools, end system and application
  - Hypermedia systems, user interfaces,
  - Authoring system, multimodal interaction
  - And integration
  - Multimedia education, virtual environments

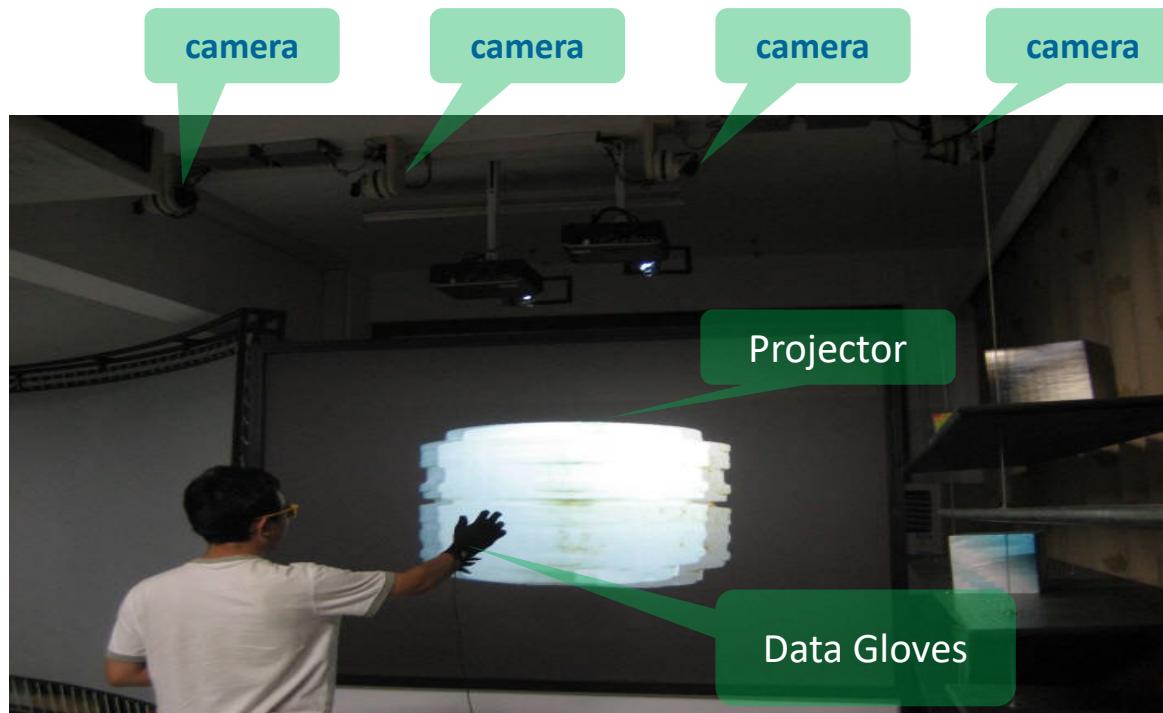


# 1.2 History: Applications

- Camera-based **object tracking** technology
  - Develop control systems for industrial control, gaming, and so on
- 3D **motion capture**
  - Produce realistic animated models
- Multimedia applications **aimed at handicapped persons**
  - Poor vision and the elderly
- Digital fashion
- Electronic House call system
- Behavioral science model

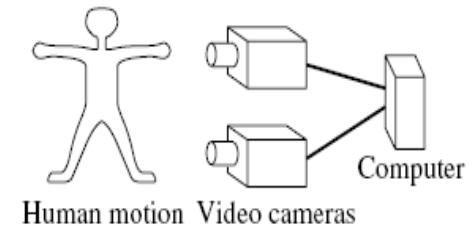
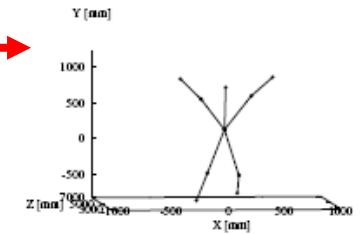
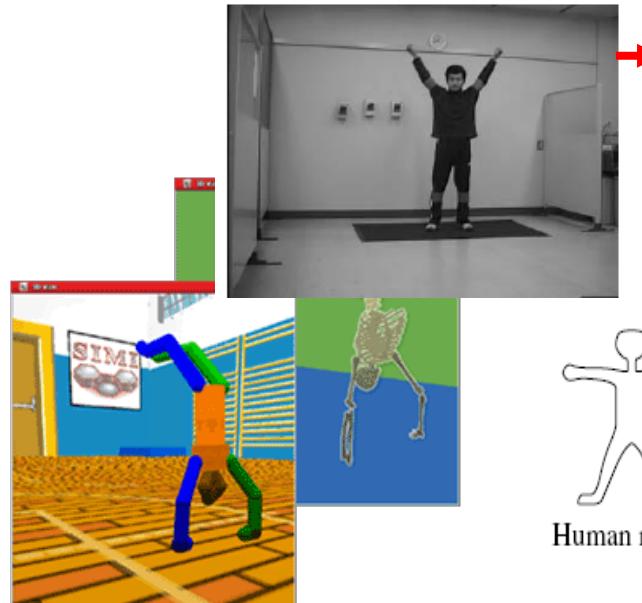
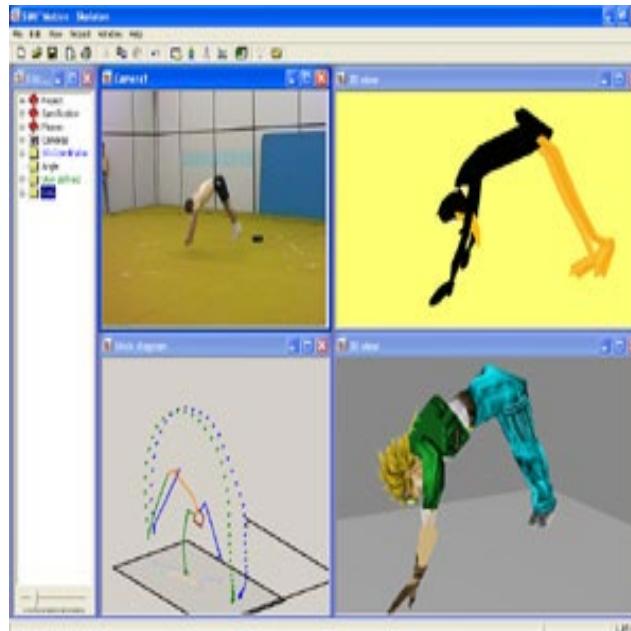
# 1.2 History: Applications

- Camera-based object tracking technology
  - Immersive interactive browsing in digital museum
  - Vision based tracking
    - Feature Acquisition
    - Multi-Source Vision
    - Data Computing
    - Interactive Output



# 1.2 History: Applications

□ 3D motion capture  
generate realistic animation model



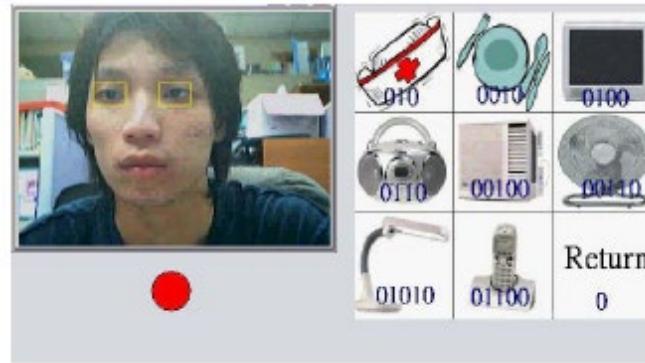
## 3D motion capture

# 1.2 History: Applications

- Multimedia Applications Aimed at Handicapped Persons

Tracking the action of eyes.

Right figures: generate  
 $8 \times 8 + 2 = 66$  actions; One  
button is return



An Automatic Eye Wink Interpretation System  
for the Disable



# 1.2 History: Applications

- Digital fashion



Mobil TV



MP3



MP4



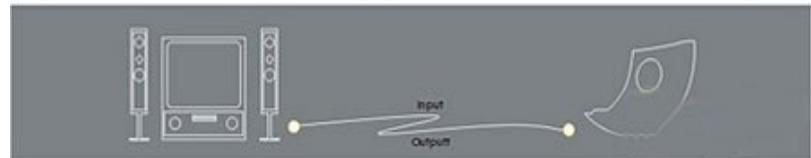
PS2 game

# 1.2 History: Applications

- Digital fashion

Music Safa:

By american designer  
Giongkun Wuqiongkun

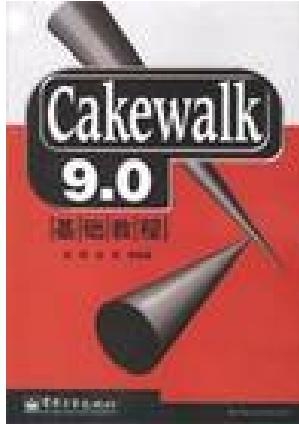


# 1.3 Typical software system

- Music Sequencing and Notation
- Digital Audio
- Graphics and Image Editing
- Video Editing
- Animation
- Multimedia Authoring

# 1.3 Software: Music Sequencing and Notation

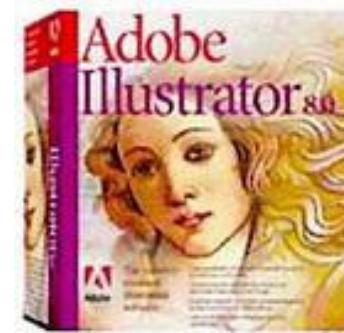
- Cakewalk, well-known older name for Pro Audio
  - Sequencing and editing MIDI music



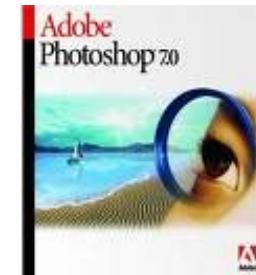
- To download from Course website

# 1.3 Software: Graphics and Image Editing

- **Adobe Illustrator**, powerful publishing tool for creating and editing vector graphics

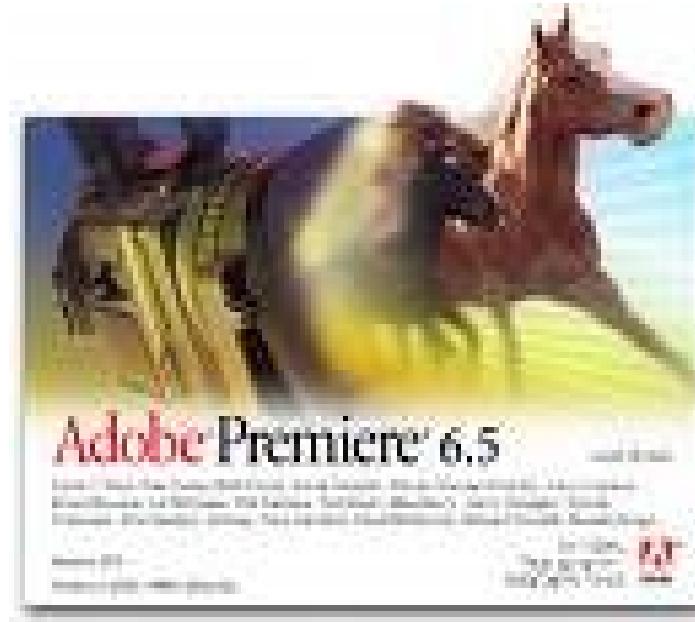


- **Adobe Photoshop**, the standard tool for graphics, image processing, and image manipulation
  - Layers of images, graphics, and text, for maximum flexibility ;



# 1.3 Software: Video Editing

- Adobe Premiere
  - A simple, intuitive video editing tool for nonlinear editing – putting video clips into any order



# 1.3 Software: Animation

- Multimedia API
  - Java3D
  - DirectX
  - OpenGL
- Rendering Tools
  - 3D Studio Max
  - Maya



# 1.3 Software: Multimedia Editor

- Macromedia Flash
- Macromedia Director
- Authorware



# The End

Thanks !

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# 计算机的“听”

- 语音识别的难点
  - □音的多样性——比如“浙普”
  - 同音多义词

最后 - 醉后	人身 - 人参	商人 - 伤人	权利 - 权力	实验 - 试验,
退化 - 蜕化	心酸 - 辛酸	合计 - 核计	姻缘 - 因缘	终止 - 中指,
治病 - 致病	专辑 - 专集	需要 - 须要		
盈利 - 营利 - 赢利		寥寥 - 了了 - 聊聊		圆形 - 原型 - 原形

小明要去医院**治病。**  
睡眠不好会**致病。**

小明要去医院**致病。**  
睡眠不好会**治病。**



借助**上下文的理解来保证**  
**语音识别结果的正确性**

# 计算机的“听”

- 当前的应用现状



**ticwatch2**  
问问手表  
腕上优雅智能  
Ticwatch 2 | 现已上市

**ticmirror**  
问问魔镜  
你的车载机器人  
Ticmirror | 现已开放众测

# 计算机的“说（读）”

- 计算机能和美女愉快地聊天吗？



# 计算机的“说（读）”

- 自然语言处理的难点是什么？
  - 无法象处理人工语言那样，写出一个**完备的、有限的规则系统**来进行定义和描述，自然语言的规则很少没有意外
  - 自然语言中有大量的歧义现象

一个普通的例子：

他马上下来  
1、他 马上 下来  
2、他 马 上 下来

一个极端的例子：

下雨天留客天留我不留  
1、下雨天留客，天留，我不留。  
2、下雨天留客，天留我不留。  
3、下雨天，留客，天留，我不留。  
4、下雨天，留客，天留我，不留。  
5、下雨天留客，天留我不？留！  
6、下雨天，留客天，留我不留？  
7、下雨天，留客天，留我？不留！  
8、下雨天留客，天！留我不？留！  
9、下雨天，留客！天！留我不留？

# 计算机的“说（读）”

- 自然语言处理的难点是什么？
  - 自然语言的理解不仅和语言本身的规律有关，还和语言之外的知识（例如常识）有关，语言理解产生歧义本质上是知识缺乏的表现

Tiger wins second US Open title!

We showed that interleukin-1 IL-1 and IL-2 receptor alpha gene ...

Protein                          DNA

我们需要构建一个庞大的知识库  
来支持自然语言的理解与消歧  
• 手工构建与维护困难  
• 计算机自动学习

# 计算机的“看”

- 计算机可以看图说话吗？——**读图**

A woman wearing a black coat and sunglasses is standing in front of a man walk away with a backpack.



A dog jumps up towards a woman in a car, while another dog is outside a car.



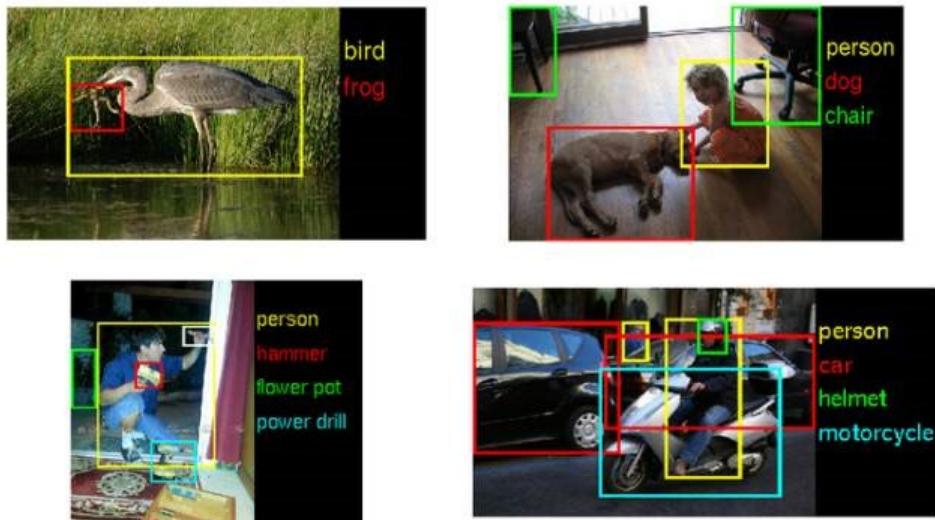
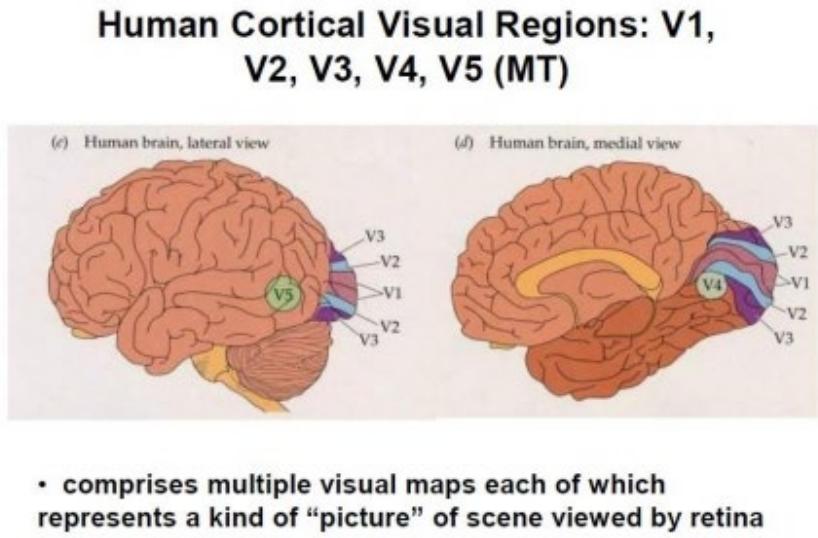
A white car is drifting. Cars racing on a road surrounded by lots of people. Cars are racing down a narrow road. A race car races along a track. A car is drifting in a fast speed.

图像描述自动生成

视频描述自动生成

# 计算机的“看”

- 计算机视觉技术正在向人类发起挑战
  - 在包含约120万张训练图像、5万张验证图像和10万张测试图像，分为1000个不同类别的“ImageNet1000挑战”中，微软研究团队开发的系统成功将辨识错误率降低至4.94%，首次低于人眼约5.1%的辨识错误率。



# 计算机的“看”

- 挑战——语义鸿沟



*Image meaning*

Semantic Gap

```
01010101110001  
101000111010101  
111000101111001
```

*Low-level  
features*



# 计算机的“写”

- 计算机能进行创作吗？比如——写一首宋词

宋词一：

西江月

饮酒开怀酣畅，洞箫笑语尊前。欲看尽岁岁年年，悠然轻云一片。  
赏美景开新酿，人生堪笑欢颜。故人何处向天边，醉里时光渐渐。

宋词二：

清平乐

相逢缥缈，窗外又拂晓。长忆清弦弄浅笑，只恨人间花少。  
风雨重阳又过，登高多少黄昏。黄菊不待清尊，相思飘落无痕。

宋词三：

佳人 点绛唇

人静风清，兰心蕙性盼如许。夜寒疏雨，临水闻娇语。  
佳人多情，千里独回首。别离后，泪痕衣袖，惜梦回依旧。

## 第一步 拟上联

## 第二步 对下联

上联 海 | 南 | 南 | 海 | 出 | 海 | 观 | 景

下联 | | | | | | | |



在输入框内输入部分下联，点击刷新候选，系统会根据规定生成完整下联

刷新候选

- 山东东山开山看花
- 江浙浙江渡江听风
- 江浙浙江渡江见春
- 山东东山上山问天
- 山东东山开山听风
- 山东东山下山目春
- 山东东山开山目春
- 山东东山下山听风
- 山东东山开山看云
- 江浙浙江渡江看天

如果您对结果不满意，推荐您 换一种方式

## 第三步 题横批

# 计算机的“写”

- 计算机撰写新闻稿



国内外主要新闻机器人一览									
国内					国外				
名称	所属机构	时间	领域	功能	名称	所属机构	时间	领域	功能
Dream writer	腾讯	2015.09	财经	写稿	Quake bot	洛杉矶时报	2014.03	地震预报	写稿
快笔小新	新华社	2015.11	财经、体育	写稿	Wordsmith	美联社	2014.07	财经、体育	写稿
DT 稿王	第一财经	2016.05	财经	写稿	Blossombot	纽约时报	2015.05	新媒体	编辑
张小明	今日头条	2016.08	体育	写稿	Heliograf	华盛顿邮报	2016.08	体育	写稿

戴资颖  
娃轻松

的戴资颖在  
的对手是现  
但经过28分  
生对手，笑到  
夺冠的机



# 计算机的“写”

计算机能代替人类进行艺术创作吗？



任重道远！