The Beauty and Joy of Computing

Lecture #5

A Computer Science Research Field: Multimedia Computing

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WHAT HAPPENS TO CALLS RECORDED FOR "QUALITY ASSURANCE"?

Audio Analysis tools do emotion and speech recognition in order to suggest solutions to the call center agent.

`http://money.cnn.com/2014/09/15/technology/enterprise/att-customer-service/index.html`

Recap: Abstraction

- **What's this?**
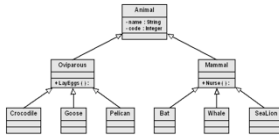

Photo: Qyd, Wikipedia

- **Abstraction: A fish**
- **Detail: Humuhumunukunukuapua'a**

Recap: Object-Oriented Programming

- <u>Classes</u> form a hierarchy through <u>inheritance</u>
- The higher the class (superclass) in the hierarchy, the more abstract.
- <u>Inheritance</u> saves code
  - Hierarchical classes
  - E.g., Bat special case of mammal, a special case of animal
- <u>Object</u> is instance of class (embodiment in memory)
  - Many concrete bats flying around

`http://www.ccs.neu.edu/research/demeter/personalities/luis/example/`

What is Multimedia Computing?

- **Multi: More than one**
- **Media: (Digital) document created for human consumption**
- **Multimedia Computing: Computing with documents created for human consumption**
  - Text document with images
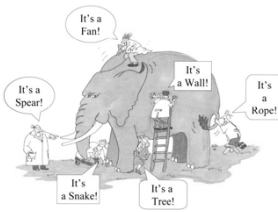 - Videos
- **Research at ICSI**
  - multimedia.icsi.berkeley.edu

MULTIMEDIA COMPUTING

Gerald Friedland
Ramesh Jain

Holistic Approach

- **Documents are created, consumed, processed, and understood as a combination of media.**
- **Otherwise: It's like only looking at the images and not the text of a book.**
- **Involves many disciplines: Computer Vision, Audio Analysis, Networking,…**

It's a Fan!
It's a Wall!
It's a Spear!
It's a Rope!
It's a Snake!
It's a Tree!

G. Friedland, R. Jain: "Multimedia Computing", Cambridge University Press, August 2014.

# How many senses does a human have?

a) 1
b) 2
c) 3
d) 5
e) More than 5

Image from: http://sblearninggarden.org/wp-content/uploads/2014/02/Exploring-the-5-Senses.pdf

Slide 1

How many senses does a computer have?

- Computer can connect to sensors.
- Sensors transform physical properties into numbers.
- Hundreds of different types of sensors exists:
  - voltage, position, speed, radiation, temperature,…

Tilt Sensor
Nevit Dilmen (Wikimedia Commons)

Humidity Sensor
wdwd (Wikimedia Commons)

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Slide 2

Sensors for Multimedia Documents

- Documents are usually created using:
  - Text (keyboard)
  - Electronic Pens
  - Cameras
  - Microphones
- Most documents, using a combination of them. Hence called Multimedia Documents

iPhone 6
Rayyuk (Wikimedia Commons)

Has 11 types of sensors!

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Slide 3

Multimedia Computing…

- …is a research area that works on creating programs to help with the
  - Creation,
  - Processing
  - Analysis
  - Consumption

of multisensory documents.

"Microsoft PowerPoint 2013 Default Screen"
Malikussaid Rayyuk (Wikimedia Commons)

Multimedia documents address several senses at once and therefore can be processed better by the brain!

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Slide 4

Example: Video Search

- With more sensors -> More Multimedia Documents
- YouTube receives 100 hours of video per minute!
- Consumer-Produced Videos largest data source in the Internet. Larger than:
  - All webpages (text)
  - All emails ever written
  - Human genome
  - All professional videos
- Today most of the traffic is videos!

Live Leak
YOUKU 优酷
twitvid
You Tube

Netflix and YouTube Are America's Biggest Traffic Hogs

NETFLIX 31.62%
HTTP 9.74%
You Tube 18.62%
Other 23.77%

statista Mashable

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Slide 5

Example: Video Search Doesn't Work!

Google "giving directions to a location"

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Slide 6

Video Search Using Audio Patterns

Cameron learns to catch (http://www.youtube.com/watch?v=o6QXcP3Xvus)

Ball sound
Male voice (near)
Child's voice (distant)
Child's whoop (distant)
Room tone

Research Performed at ICSI

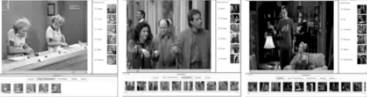Friedland

An Experiment

Listen!

- Which city was this recorded in?

Pick one of: Amsterdam, Bangkok, Barcelona, Beijing, Berlin, Cairo, CapeTown, Chicago, Dallas, Denver, Duesseldorf, Fukuoka, Houston, London, Los Angeles, Lower Hutt, Melbourne, Moscow, New Delhi, New York, Orlando, Paris, Phoenix, Prague, Puerto Rico, Rio de Janeiro, Rome, San Francisco, Seattle, Seoul, Siem Reap, Sydney, Taipei, Tel Aviv, Tokyo, Washington DC, Zuerich

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Example: Video Navigation

Joke-O-Mat: Browsing Sitcoms Punchline by Punchline

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Research Performed at ICSI

Summary

- **Beauty and Joy of Computing? You bet!**
- **Multimedia documents convey Information better**
- **Multimedia Computing is everywhere: We are creating and consuming documents on a day-to-day basis.**
- **Interdisciplinary field!**
- **Biggest Big Data!**
- **Many future opportunities!**
  - Send me email for a visit at ICSI!