

## CA168 - Digital World



### Chapter 7 Personal Media Organisation

## Introduction

- We have previously looked at how people manage large libraries of digital content, when there was an editor or a librarian.
- With personal media, you are the editor, you are the librarian.
  - This puts the onus on you for:
    - Capture
    - Organisation
    - Backup
    - Format Migration
- Of course, there are commercial solutions to solving this problem... firstly the data:

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## Personal Media

- Photos
  - 35,838 photos, 6.5 million sensecam photos
  - Requires about 180GB of data (€90 for 2000GB)
    - Amazingly this is 4 cent per GB... \$895 in 1995 for a 1GB drive.
- Audio files
  - How many files on your music player?
- Videos
  - MP4, DVDs, DVRs, VHS?
- Documents
  - Letters, projects, e-books...
- Emails
  - Managed by Gmail? Outlook?
- SMS messages
  - On my phone? Backup anywhere
- ... any others?

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## Backup and Recovery

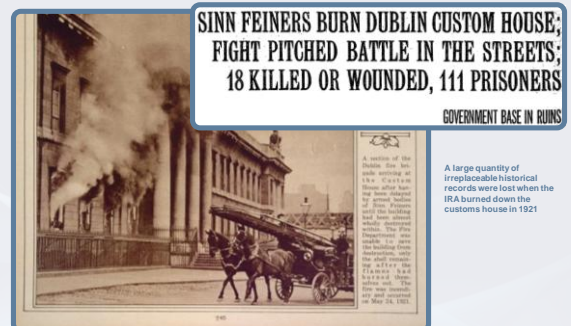
## Backups

- Is there any of your digital data that you do not want to lose?
  - Your photos, videos???
  - How about your projects the day before the deadline?
- 82% of home users hardly bother to backup their data
  - <http://news.bbc.co.uk/2/hi/technology/8172568.stm>
- Data loss disasters happen all the time!
- With paper there is no easy backup
- With digital data there can be, but do people do it?



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## One example of Data Loss



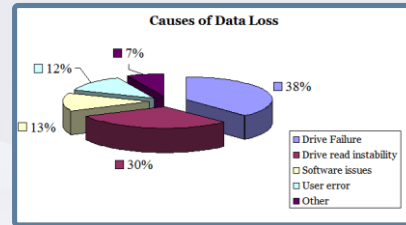
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## Digital data and backups

- A backup refers to making copies of data so that these additional copies may be used to restore the original after a data loss event.
- In the digital world, it takes a lot less than a fire to destroy data, for example
  - corruption of data happens
    - E.g. Word crashes while writing a document
  - hard drives will fail
    - MTBF: Mean Time Between Failures is not so large
  - motherboards will short out
  - mistakes will erase data
    - delete the wrong version of the file!
  - and the USB key will be lost
- The average cost to a company of a data loss incident is about €2,000
  - <http://www.deepspar.com/wp-data-loss.html>

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## Why would one loose data..



<http://www.deepspar.com/wp-data-loss.html>

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## What are the backup options?



- Magnetic tape
  - Older solution
- Hard Disk
  - Simply copy to an external Hard Disk
- Optical disc
  - Burn a CD or a DVD
- Solid state storage
  - Copy to a USB stick
- RAID redundancy
- Remote backup service
  - Many online solutions, but do you want your data to go online to someone else's servers?

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## It happens...

- It will happen to you, most probably:
  - The laptop will not turn on one day
    - Maybe you dropped it, maybe it just does not work
  - The USB stick will be lost
    - Or simply not work anymore
  - The file was deleted, just before the project deadline!
    - It happens... all the time
- Simple solution.. Is to BACKUP

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## Personal Media Collections

### Overview of Personal Media

Scenario 1 : Human Digital Memories "My Life Bits" Project

Scenario 2 : Managing Personal Photos

Scenario 3 : Managing Digital Video Content

Scenario 4 : Managing My Music

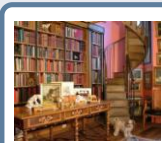
## Personal Media Gathering

- The computing infrastructure allows us to gather vast quantities of data
  - Technology has been great at letting us gather content, but not so good at managing content, any examples?
  - Cheaper to gather and search than to organise
    - Google v.s. Yahoo
- Generation C : The Content Generation phenomenon refers to the generation of consumers that have moved from consumers of content (e.g. TV watching) to creators of content.
  - Blogging, photo sharing, video uploading...
- This causes some interesting problems, such as...
  - What is a personal collection?
  - Who should access it?
  - What happens to someone's digital estate?

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## Defining Personal Collections

- People have always gathered personal collections of physical artefacts, as external memory or reference aids
  - Libraries of books, art, antiques...
- The modern version of this is digital data, and everyone can gather it, free readership.
  - So, who owns the data?
  - What about copyright?
    - Have you bought all your MP3s?
    - Ever downloaded a movie?



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## Access Rights

- Access Rights to your data is an important consideration
  - Public, Private, Friend.. Three way sharing
  - Are you concerned with what is online about you?
- But what happens if your data is stolen?
  - What if your laptop is stolen?
- Personal Data used in police cases
- If externally stored on some WWW service, who can access it legally?

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## Digital Estates

- Following the death of an individual, who has access to the content?
  - Likely digital executors with access to passwords of digital estates.
- Maybe the digital estate is password protected and no one has the password
  - Reidar Djupeal – Maintainer of an index of over 11,000 digital titles at a language and culture centre in Norway.
    - Took hackers five hours to crack the password
    - Would have taken four years to recreate the data.



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## Organising Personal Media

Motivational Scenario : Human Digital Memories  
 Personal Media Challenges  
 "The Semantic Gap"  
 Example Scenarios for photos, videos and audio

## Human Digital Memories

- A Human Digital Memory (HDM) is a surrogate of your own memory, though in digital form.
- Although it may sound like Science Fiction, it is being done now, though not quite as intrusively as you would think
- Sometimes its for a reason,
  - work ... e.g. security personnel, medical staff,
  - personal ... e.g. diaries, blogs, etc.;
- Sometimes its for posterity, recording vacations, family gatherings, social occasions;
- Sometimes its because we can, and we are still researching how we can use it

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## How to construct a HDM



- Humans have been finding ways to substitute memory for a long time
  - From druids to books, dairies, blogs...
- For HDMs we can...
  - Logging our computer usage
  - Logging our communications
  - Logging what we see and do
    - **Visually**, aurally,
  - Recording biometrics;
    - Logging our health, fitness, activity, etc...
  - Logging our environment;
    - Traffic, pollution, **people near us**, etc...
  - **Movements**
    - My movement log is since November 2005

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### Recording my locations



This is easy, we only need to carry our modern mobile phone...  
<http://bit.ly/cathal>

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### Recording my Activities

You only need an accelerometer enabled phone and some clever software... to get 98% accuracy!

Walking, standing, running, driving, and so on... not so far from eHealth



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### Recording people I meet

- Hmm.. My phone can do this... see a pattern ?
  - By using the bluetooth sensor
- We can :
  - Identify a social network automatically
  - Find out who is near us
  - Share data with them.



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### Logging what we see...

- Capture digitally what a person sees and experiences over a period of time
- Envisaged by:
  - Vannevar Bush in 'as we may think' as a Walnut sized camera on one's forehead
  - Bill Gates in "The Road Ahead"
  - Many others and in many books and movies
- This has become a reality, lead by projects such as MyLifeBits, Sensecams, many other devices and Mr Lee, the lifelogging cat.



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### Logging what I see....



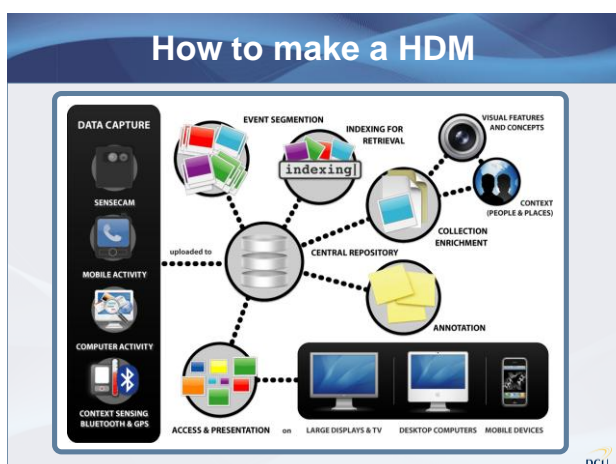
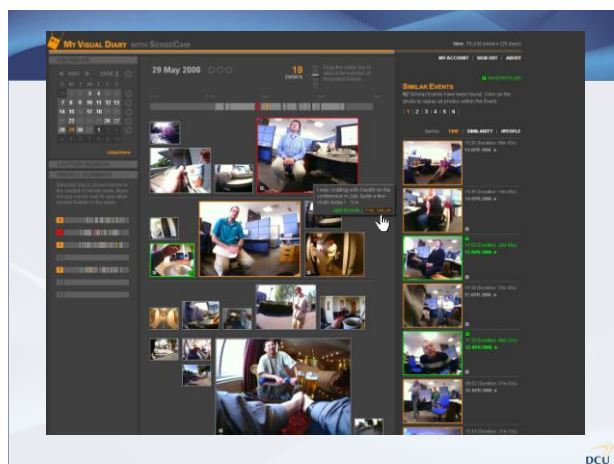
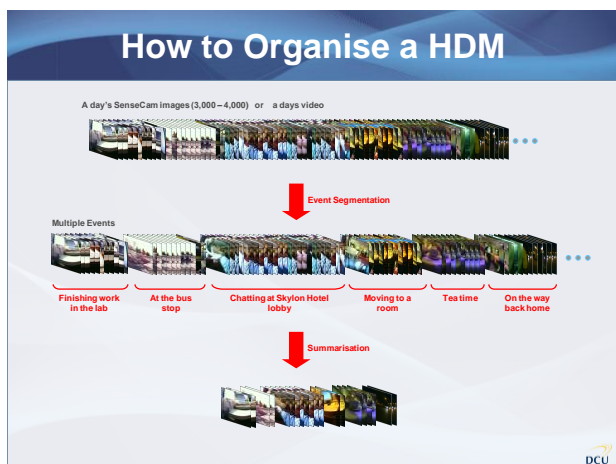
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### Passive Capture

- Passive capture devices are needed, such as the SenseCam from MSR
- Sensecam Multi-sensor device:
  - colour camera (vga with fisheye lens)
  - Sensors
    - 3 accelerometers
    - light meter & passive infrared sensor
  - A week of storage and 18 hours per day
  - Smart image capture ~3 images/min
- Looxcie Wearable video camera
  - Five hours of recording
  - Full video & audio





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- ### Why would you do this?
- Because we can:
    - My life on 1TB of photos or ?TB video, audio another TB.
    - In 2020 2TB = €10
    - People blog, so this is an extension of blogging
  - Health Benefits of Lifelogging
    - The Frammington Study has shown the benefits of logging an aspect of peoples lives.
    - Much research into Sensecam wearing for Alzheimers sufferers.
  - Finally, is it a SnowBall Technology?
    - Like facebook, my friends have one, so I want too...
  - It costs more to delete than to store
  - Preservation... for me and maybe for others
  - Stories and Ambience
  - Surrogate Memories
  - Environmental Rational
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### Who would use it?

- People who want a digital memory of their life
  - Automatic visual diaries, richer in data than we could imagine
  - Ability to show like experiences to others
- People with memory difficulties
  - Microsoft study has shown initial memory benefits
- Bloggers keen for a new technology, more enriched blogs
- Medical professionals
- Security professionals
  - UK police testing head mounted video cameras
- Many more!




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### My Life Bits : The 1 TB Life

[http://research.microsoft.com/~GBell/Bell\\_MyLifeBits\\_Accelerating\\_Change\\_041106.ppt](http://research.microsoft.com/~GBell/Bell_MyLifeBits_Accelerating_Change_041106.ppt)

- My Life Bits – a Microsoft Project
- 1TB gives you 65+ years of:
  - 100 email messages a day (5KB each)
  - 100 web pages day (50KB each)
  - 5 scanned pages a day (100KB each)
  - 1 book every 10 days (1 MB each)
  - 10 photos per day (400 KB JPEG each)
  - 8 hours per day of sound - e.g. telephone, voice annotations, and meeting recordings (8 Kb/s)
  - 1 new music CD every 10 days (45 min each at 128 Kb/s)
- It will take you 5 years to fill up your 80 GB drive
- Want video? Buy more cheap drives (1 TB/year lets you record 4 hours/day of 1.5 Mb/s video)



Slide is © Microsoft DCU

### So you've got it – now what do you do with it?

*“A record if it is to be useful ... must be continuously extended, it must be stored, and above all it must be consulted”*

*“The difficulty seems to be, not so much that we publish unduly ... but rather that publication has been extended far beyond our present ability to make real use of the record”*

- Vannevar Bush

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Would you like to maintain your own HDM? Would you wear a Sensecam? Or a different device?

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### Organising Personal Media

Motivational Scenario : Human Digital Memories

#### Personal Media Challenges & the Semantic Gap

Example Scenarios for photos, videos and audio

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### The Challenges


- Media is not text
  - Can not simply rely on text search engines
- The Human-Computer mismatch
  - Computers can not 'understand' the meaning of images, videos, ...
  - Humans can not describe queries/information needs in the ways that computers can ...
  - There is a MISMATCH –semantic gap
- Visual processing tends to be slow and resource intensive
- Humans are used to text querying



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## The Semantic Gap

- The semantic gap characterizes the difference between two descriptions of an object by different linguistic representations,
  - for example human description of an image compared to a computer description
    - Sunset v.s. red and yellow colours
  - Human description tends to be based on understanding or implied meaning
  - Computer description tends to be low-level easily identifiable concepts like colour and shape
    - Computers can match very visually similar content



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## Solutions to the Semantic Gap

- Media annotation as text
  - Automatic, as we have seen in Digital Libraries
  - Manual, human tagging, as in YouTube, Flickr
- Or Automatic Understanding Tools
  - Try to build software to understand images, to describe their content.. Videos and audio too.
  - Try to bridge the Semantic Gap
- Perhaps include human verification of automatic annotations.

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## Annotation / Tagging

- The typical approach, and we know a lot about this already from chapter 4
  - Automatic annotation using available metadata
    - TV shows, photos, MP3s...
  - Manual Tagging, using human defined metadata
    - E.g. home movies will not have automatic metadata, except time/date
- We will not look at manual annotation/tagging in more detail, except to say that...
  - Converting media to text means that we can index like a search engine and users can query using text
    - But... how can we do this on a TV?

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## Tags and Tag Clouds

- A tag is a keyword or term given to a piece of information (such as an internet bookmark, digital image, or computer file).
- It is non-hierarchical, i.e. not from an ontology.
- A tag is a type of metadata and helps describe an item and allows it to be found again by browsing or searching.
- Tags are chosen informally and personally by the item's creator or by its viewer.
- On a website in which many users tag many items, this collection of tags becomes a folksonomy.
- Tagging was popularized by WEB 2.0 websites.



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## Tagging Content in Flickr

**Nordlys**



The magic northern lights, Tromsø, Norway, January 2007. A cold winter evening, a cloudy sky that suddenly cleared.

This photo has notes. Move your mouse over the photo to see them.

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## Tag Cloud

- Use tags to summarise/present information, not just index it... Recent RTE NEWS data.



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## Who wants to annotate!!!

- Ok.. This is tagging and text search.
- What if we want to index multimedia data without ever having to annotate, e.g.:
  - Who is in the photo?
  - Where was the photo taken?
  - What is happening in the video?
  - What songs sound like this?
- For this to work, we need context and content analysis.
  - To help bridge the Semantic Gap without annotating and relying on text

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## Context Analysis

- Context is the environment in which an operation takes place
- Organising data by examining the context of the data when it was captured is a key method for organising media
  - Best example is photos... when capturing a photo, what context can you gather??
  - 
  - 
  - 
  -

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## Context in photo capture

- When : date and time
- Where : location, using GPS usually
- Who : the people in the photo
- Other Context:
  - Weather
  - Light status
  - What : were you doing at the time
  - What : were you saying
  - Why : were you there
- This is also applied to Human Digital Memories as we will see.

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## Content Analysis

- An alternative/complementary organisation mechanism is content analysis.
  - Automatically getting software to analysis a photo/video to determine what is happening in the photo/video
    - i.e. to be able to describe the content
- This is not easy to do because automatic understanding tools have been (to date) **impossible to develop**
  - Therefore, people use automatic understanding tools to do simple things like:
    - find a photo/video that looks like this one
    - In effect, a form of relevance feedback, or linkage.

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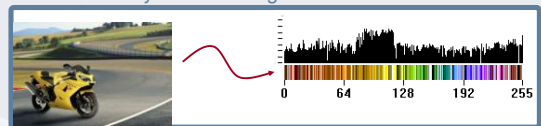
## Content Analysis – more detail

- easier ↑
- ↓ More difficult
- **Level 1** - using simple image details.
    - Relatively easy to accomplish
    - E.g. colour, texture, shape
  - **Level 2** - based on derived attributes
    - Asks what the simple image details mean...
    - Much more difficult than level 1
  - **Level 3** - inferred abstract attributes
    - Asks what do the derived attributes mean...
    - Far more difficult again...
    - Requires abstracting from level 2
      - E.g. what is a football match?

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## Simple Image Details - Colour

- Colour is a basic feature that you can easily extract automatically from an image



- This is a colour histogram... you can see which colours are represented in an image more than others...
- Allows finding more images like this one... a type of relevance feedback.
  - This is not done by most search engines... why?
  - Do you think it is useful?

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### Simple Image Details - Texture

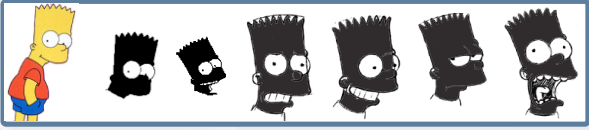
- **texture** - what is texture?
  - a measure of properties such as smoothness, coarseness and regularity;
  - so a query could be:
    - find images with regions of texture similar to grass.




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### Simple Image Details - Shape

–**shape** ... geometric shapes, 2D ... find images containing a shape similar to this sketch...



Complex shapes are difficult to process...!




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### Level 2 : Derived attributes


- In images we also have derived attributes such as the presence of specific objects e.g. chairs around a table, named specific individuals, or specific features (indoor/outdoor & landscape/cityscape).
- Level 2 is retrieval based on derived attributes (describing a picture's actual contents, or icons).
  - By developing software detectors...
- This would include queries like:
  - find pictures of an outdoor cityscape scene with cars on a road,
  - or even find pictures of a train crossing a bridge...

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### Level 2 - examples



"Picture of Bill Clinton with Gerry Adams"



"Picture of a yellow motorcycle on a road with a landscape backdrop"

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### Performance of Content Analysis

We took sensecam photos and applied state-of-the-art derived attribute detectors... concept(accuracy)

– Steering wheel (72%)	– Eating food (41%)
– Shopping (75%)	– Screen (computer/laptop/tv) (78%)
– Inside of vehicle when not driving (airplane, taxi, car, bus) (60%)	– Reading paper/book (58%)
– Toilet/Bathroom (58%)	– Meeting (34%)
– Giving Presentation / Teaching (29%)	– Road (47%)
– View of Horizon (23%)	– Vegetation (64%)
– Door (62%)	– Office Scene (72%)
– Staircase (48%)	– Faces (61%)
– Hands (68%)	– People (45%)
– Holding a cup/glass (35%)	– Grass (61%)
– Holding a mobile phone (39%)	– Sky (79%)
	– Tree (63%)


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### Level 3 – Semantic Abstract Attributes


- More abstract still, we have inferred abstract attributes which do not correspond to any direct content in the image, i.e. nothing obvious, but to some inferred attribute,
- e.g. if we have football players and a goalpost and a football in a picture then we have a football match. This is level 3 (**iconology**: describing a picture's deeper artistic significance)

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### Level 3



"Picture of an F1 motor race"



"Picture of a storm over a city"

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### Bridging the Semantic Gap

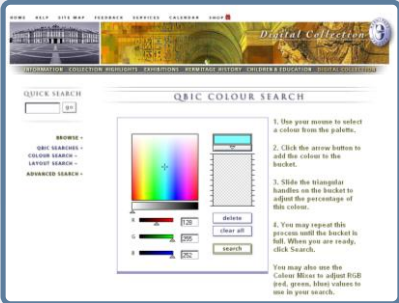
- Using content analysis we can try to represent the media content in a way that the computer can understand and that the human can query...
- But it is not a solved problem.
  - It fails many times
  - So we tend to rely on context and manual annotation to manage our photo collections

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## Scenario 1 : Using Content to Search Image Archives

The Content is Colour, so a simple content. Not any derived attributes.

### QBIC at the State Hermitage Museum



[http://www.heritagiumuseum.org/templ\\_En/index.html](http://www.heritagiumuseum.org/templ_En/index.html)

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### Query 1



1



4



5



6



8

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### Colour & Shape: QBIC Layout Search



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### Example Query

delete clear all search

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### Visual similarity in Google

Google sunset

Related searches: Beach sunset, Sunset city, Sunset sky, Sunset wallpaper, Ocean sunset, Sunset clouds

Images

Any size

Any type

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## Scenario 2 : Managing Personal Photos using Content

Using Context (and a little content) to manage personal photo archives

### Personal Photo Management

- People take a lot of digital photos
- How to manage large photo collections?
  - Event segmentation and thumbnail display
  - Context organisation
    - Using Time/Date and Location as the key organisation techniques
      - Deriving weather, light status, day of week, weekend...
  - Manual Text annotation
  - And adding the output of visual detectors, we can improve the process.
    - E.g. find only photos with people in them

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### Context in photo capture

- When : date and time
- Where : location, using GPS usually
- Who : the people in the photo
- Other Context:
  - Weather
  - Light status
  - What : were you doing at the time
  - Why : were you there
  - ...

<http://pubs.stanford.edu:8090/660/1/2004-43.pdf>

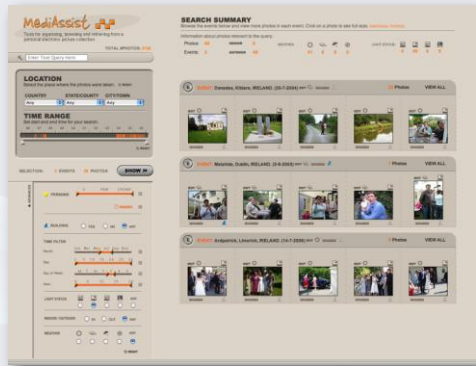
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### MediAssist Photo Management

- Browsing
  - Event-based browsing of photos
  - So 1,000 photos may occur in 50 events, making it easier to browse the collection if viewed as events
- How to organise the Photos to bridge the semantic gap:
  - Use Context: Time, Location, Light Status, Indoor/Outdoor, Weather
  - Use Content: Face Detection & Recognition, Building Detection
  - Support Text searching or browsing

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## MediAssist - Desktop Interface



## Comparison to other tools?

- So, how does Mediassist compare to other photo management tools that you use?
  - Google Picasa
  - Flickr
  - Any others?
  - ...
  - ...
  - ...

## Scenario 3 : Managing Personal Video Archives using Content Analysis and Text Search

How to organise a personal video archive?

## Personal Video Collections

- How to organising a collection of personal video depends on the video type:
  - Broadcast video – can rely on EPG data
  - WWW video – can rely on Human annotations and tagging, as in youtube (as we have seen previously)
  - Personal Video (Cameraphone or Camcorder)
    - Needs either manual annotation, or automatic analysis, just like we do for photos
    - However:
      - The typical video viewing environment is not a computer, it is a TV.. And this causes problems for video organisation
      - Why?

## Here is one example...

- Video Search Engine operating over:
  - Text Evidence
    - Spoken words converted to text
    - Closed Caption (teletext) text
    - OCR from on-screen characters
  - Visual Evidence
    - Level 2 features (face) and level 1 features (colour, edge, texture, etc...)
- This means that you can find video using both text and 'example' queries



## How about in the living room?

- Large archives of video available on set-top boxes
- Four major constraints of the living room environment:
  - Viewer sitting at a distance (typically 2 - 3.5m)
  - Use of remote control
  - Enjoyment-oriented
  - Divided attention between playback and interactive elements
- This all means that for managing personal video collections in the home, that the interface and the query mechanisms must be carefully chosen.



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## Example TV search



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## So, to make real progress, we need to better understand the video

- To bridge the semantic gap, we can:
  - Support video browsing/linkage based on the colour, texture, etc...
  - Index the video using derived attributes:
    - People, known faces,
    - Location (indoor, outdoor, etc...)
    - Objects (cars, boats, airplanes, etc...)
    - Events (explosions, crash, etc...)
  - Capture the EPG text, the Closed Caption Text, the ASR text and any related text from the WWW, such as Wikipedia or IMDB

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## Scenario 4 : Managing Audio Archives

Indexing spoken words  
 Tagging Music  
 Indexing Music Automatically  
 Example System : Ceolaire

## Content Retrieval of Audio

- Divided into speech and non-speech:
  - **Speech** the applications are in :
    - radio/TV news retrieval
    - searching other radio/news
    - audio archives of meetings
    - audio archives of lectures
  - **Non-speech** – the applications are in:
    - More music like this...
    - A song that goes like this...
- If speech, we simply run Automatic Speech Recognition software and convert the spoken words to text, and index like a search engine for text does

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## Tagging Music

- Automatic music annotations from a source such as CDDB
  - Over 6 million CDs
  - Over 80 million tracks
- No need to manually annotate music from a CD when you put it on your IPOD
  - Data is there to browse/search
- Would you be bothered to manually tag all your CDs?



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## Content based retrieval of music

- Waveform matching?
  - Song to song matching is possible, and works today
  - However, human to song is difficult, because is difficult for a human to produce a perfect query which would support note-note matching
- So, we can:
  - extract the notes from the digital music...
    - Using a lot of complex maths (FFTs)
  - Once the notes are extracted we can then do conventional (text) retrieval.
    - How? Treat the notes like words.. or UDS

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## UDS Notation

- UDS – Up, Down, Same
  - a perceived change in pitch is enough to match tunes from human memory.
  - Hence indexing music by UDS could work.
- The melody of a music file is found by comparing the change from one note to the next.
- UDS string is treated like a text document:
  - Retrieval is using BM25... (text IR)



UDSSUUUUUDS...

UDS, DSD, SDS, SSU, SUU, UUU, UUU, UUD, UDS, ...

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## In Summary

- We have seen Search Engines for text in chapter 3 which relied on software to organise billions of documents
- In chapter 4 we saw digital libraries and editorial organisation of smaller quantities of documents
- In this chapter we have seen how people can organise their personal media
  - You will be doing this for the rest of your life, and the examples presented in this chapter are state-of-the-art commercial and research systems
    - However, in five years time, these will be out-of-date
  - We have shown the problem of the semantic gap for personal media organisation, and presented some approaches to solve this problem.

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## Our Digital Footprints & Privacy of Data

## Digital Footprints


- Digital Footprints are the electronic evidence of a computer user's activity (online, local, etc.).
- How is our footprint gathered?
  - Search Engines
  - Social Networks (e.g. Facebook)
  - E-commerce
  - Simply using a WWW browser or registering on WWW sites
  - Blogging or commenting on blogs
- Have you ever tried to search for your name online?
  - 47% of people have...
    - [http://www.pewinternet.org/pdfs/PIP\\_Digital\\_Footprints.pdf](http://www.pewinternet.org/pdfs/PIP_Digital_Footprints.pdf)
  - How does Facebook add to your digital footprint?

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## Facebook




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**People on Facebook**  
 More than 500 million active users  
 50% of our active users log on to Facebook in any given day  
 Average user has 130 friends  
 People spend over 700 billion minutes per month on Facebook

**Activity on Facebook**  
 There are over 900 million objects that people interact with (pages, groups, events and community pages)  
 Average user creates 90 pieces of content each month  
 More than 30 billion pieces of content (web links, news stories, blog posts, notes, photo albums, etc.) shared each month

**Mobile**  
 There are more than 200 million active users currently accessing Facebook through their mobile devices.  
 People that use Facebook on their mobile devices are twice as active on Facebook than non-mobile users.  
 There are more than 200 mobile operators in 60 countries working to deploy and promote Facebook mobile products

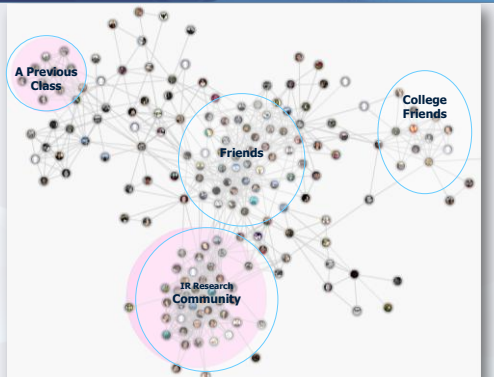




**Global Reach**  
 More than 70 translations available on the site  
 About 70% of Facebook users are outside the United States  
 Over 300,000 users helped translate the site through the translations application

**Platform**  
 More than one million developers and entrepreneurs from more than 180 countries develop platform apps...  
 More than 550,000 active applications currently on Facebook Platform  
 Every month, more than 70% of Facebook users engage with Platform applications... what information do these store about us?



## Facebook Social Graph

## TWITTER




## Looking ahead...

- How will our digital world change in the coming years?
  - What data will be kept? What devices will we use?
- Will Ireland become the digital economy/knowledge society it is supposed to become?
- How will our digital footprints be used?
- How much of our life will be recorded digitally? And how much will we own?
- What will happen to our digital data when we are gone?
- What is the effect on privacy of these issues?
- How will we access data in the future?
  - Books, TVs, mobile devices...



## Privacy...

- Are we losing privacy in the Digital World of 2010?
- Are you concerned?



