LIVING WITH SENSECAM

Experiences, Motivations and Advances

Dr Cathal Gurrin
CLARITY, Dublin City University, Ireland

SOME BACKGROUND

- Lecturer at Dublin City University
- PhD in Search Engine Algorithms
- Director of the Human Media Archives Research Group (15) and CLARITY Investigator (100+)
- Sensecam wearer since June 2006
- Research into Personal Information Management, Information Retrieval & HCI

"Synergy with, not substitution of" human memory.

Sellen & Whittaker, 2010

WHAT IS THIS TALK ABOUT?

The terminology

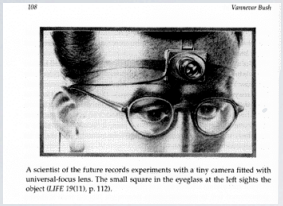
Firstly a Confession. I am a search engine geek!

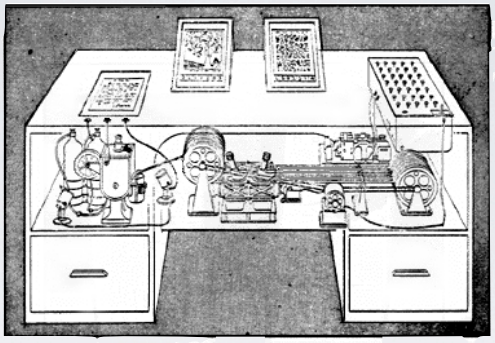
This talk is about my experiences and how they have informed our technical progress in developing Personal Life Archive prototypes.

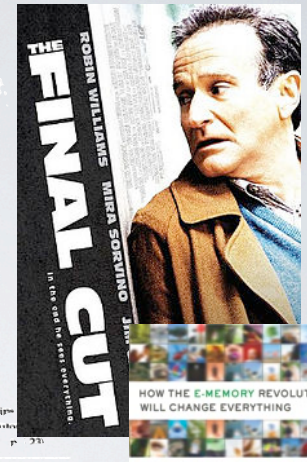
My assumption? We will want to use our Personal Life Archives for a variety of reasons... 5Rs

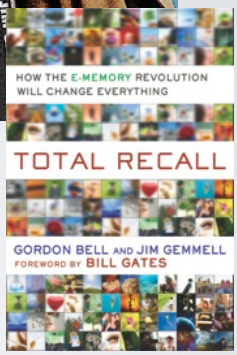
Reminiscence, Reflection, Recollection, Retrieval & Remembering Intentions

"Someday you will be able to record everything you see, hear, feel and experience"
Bill Gates, The Road Ahead (1995)





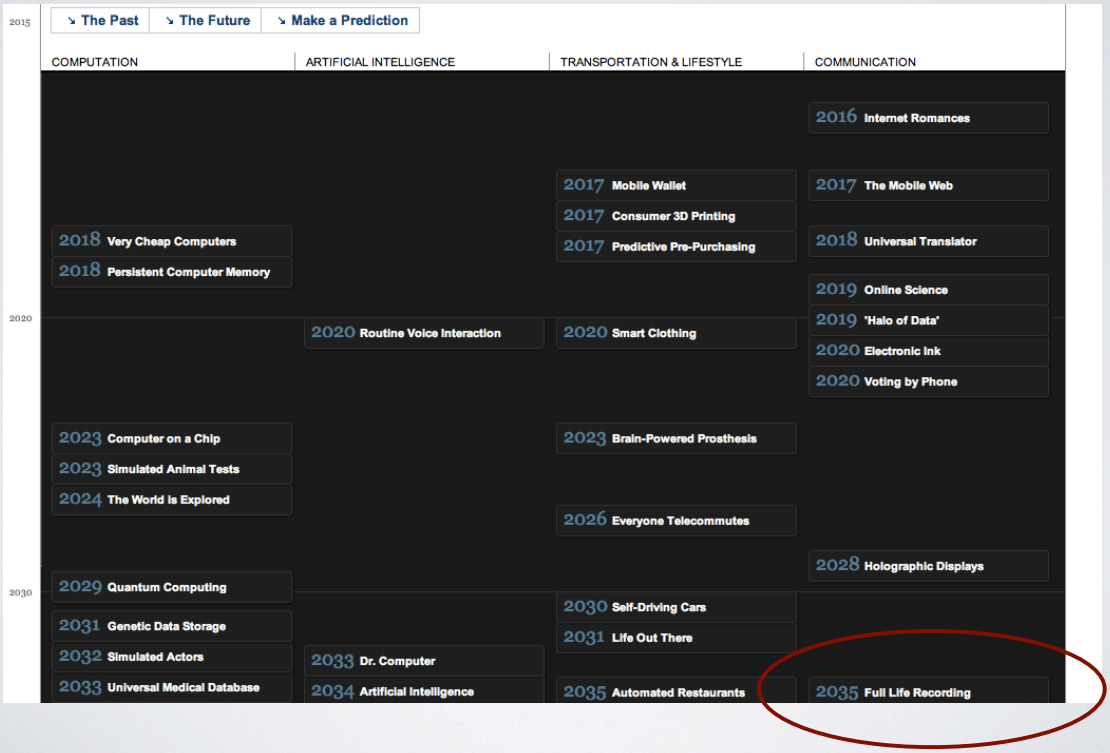




FOR 70 YEARS...

This has been discussed in publication and cinema...

NEW YORK TIMES - 2012



HOT COMMERCIAL SPACE

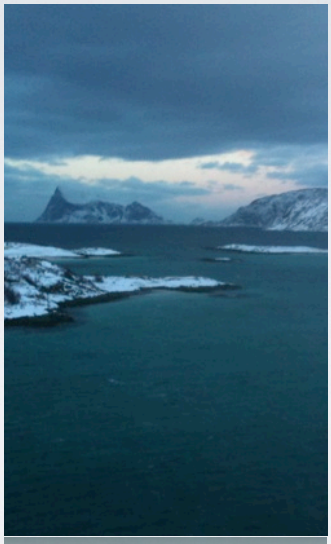
This is happening now... we are waiting for the 'killer app'

AGENDA

- Personal Insights
- Gathering Personal Life Archives
- Storing Personal Life Archives (forever)
- Organisation and Access
  - Senseseer Platform
- The User Interface

PERSONAL INSIGHTS

|



WHY DID I START?

I wanted to understand the technology and develop the Search Engines to make access to personal life archives easier

625M
SENSOR READINGS

58,000
EVENTS

36,165
AWAKE HOURS

9 M
PHOTOS

5.5
YEARS

100,000
SCREENSHOTS

The 'Big Data' Challenge

1TB
OF DATA

125,000
PEOPLE

34M
GPS Locations

127
SECONDS

WHAT DO I GATHER?

- Sensecam : 5,000+ per day. Morning until night. More recently, I also use SenseSeer (smartphone software).
- Location: even before Sensecam. It is a key access methodology.
- Bluetooth: though it does not fulfull its potential yet.
- Activities: physical activities, energy expenditure, steps.
- Screenshots of my computers (20s).
- Various other forms of digitized and digital data.

FAVOURITE SHOT

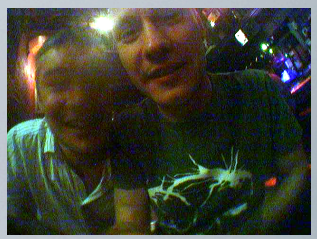
GUIDING INSIGHTS

- Vast 'big data' archive. Can not rely on date browsing. Frustrating!
  - Over 2.5 Years of data, 35 events per day, 14h,22m per day. Archive too large to find by browsing.
- Multi-axes search is needed for 'big data' archives
  - This is an expected finding based on knowledge from Multimedia Information Retrieval field. It tends towards 'total recall'.
- Some form of Event Segmentation is needed. Also needs novelty detection.
  - To allow 'drill down' to support within-event browsing.
  - Detecting novel events using sensor data is not easy!

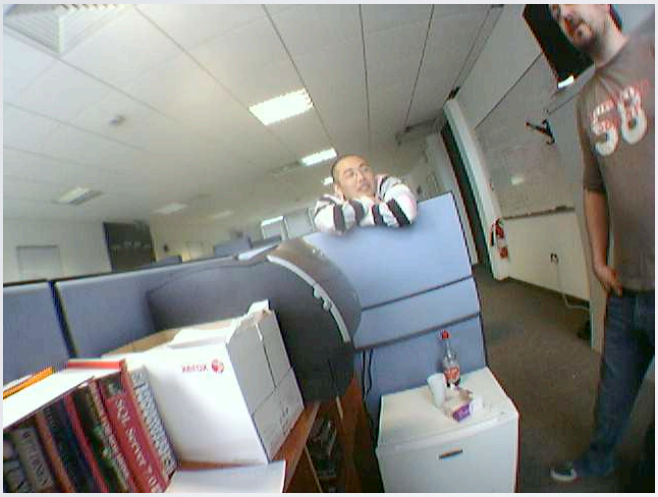
EXPERIENCES OF SENSECAM

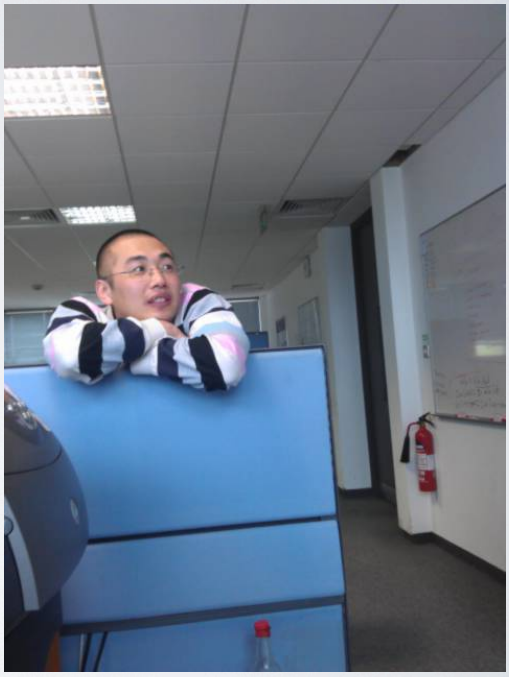
- Few complaints over the years; four times only; people do notice it all the time, most do not ask; I can not tell everyone!
- More people have been happy to see the 'James May' camera than are unhappy to be photo'ed.
- Audio is still a problem; the second question!
- Immediately habitual; forgotten only once in 5.5 years; involuntary reactions.
- The lights do not impact at all.
- The sensecam only lasts about 1 year.

PEOPLE DON'T MIND



IMPORTANCE OF FISHEYE





Regardless of our research efforts, this will happen soon. Life capture, life streaming. The technology is there. Some people will be comfortable to partake, many will opt out.

I believe that the Facebook generation will embrace it once the 'killer app' is released. This 'killer app' will not be a carefully researched medical technology, it will be social, built on information retrieval technologies.

We will gather many sensors, not just photos. In fact photos may not be needed for many people.

GATHERING

2

Capture as much as we can, in a low-overhead manner. We should not limit data capture to fit into some ideal scenario.

We don't know [many of] the potential uses now, so why limit capture?

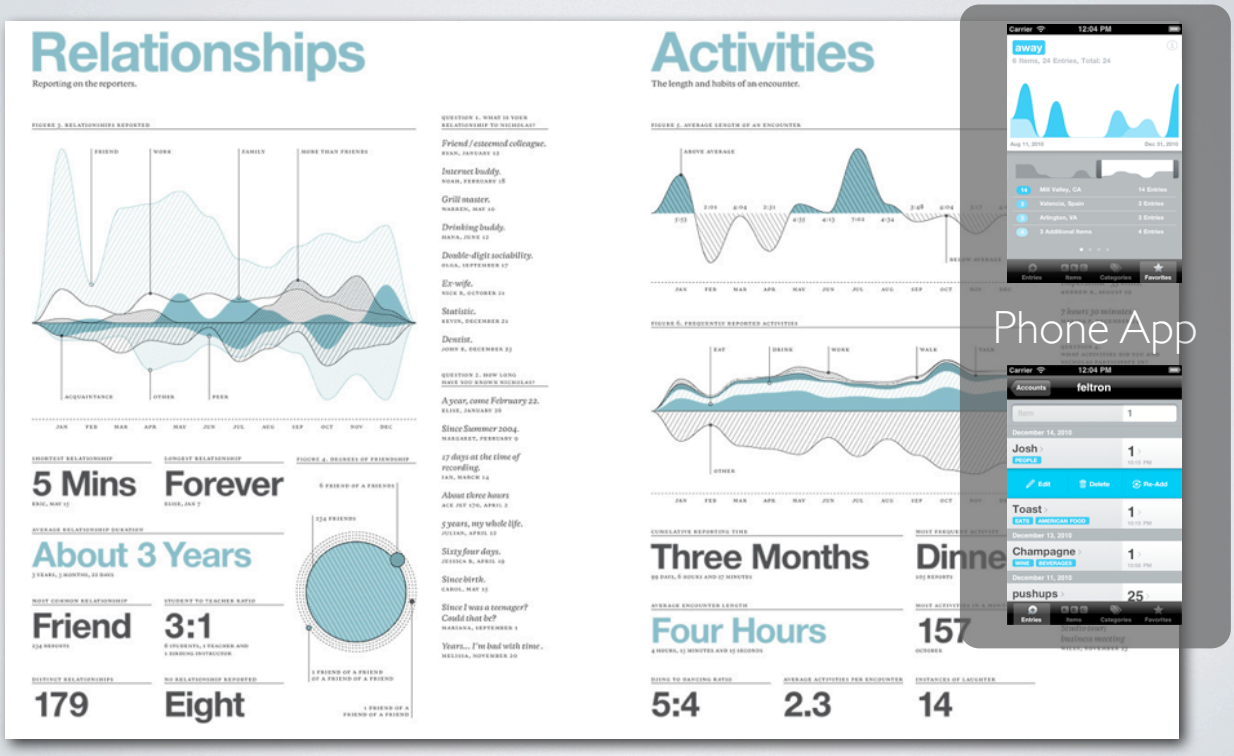
HOW MUCH TO CAPTURE?

- Suggestion of Total Capture, but some criticism... however:
  - Automatic and effortless capture is easy; manual crafting is difficult.
  - Automatic, detailed capture is not aiming to recreate memory; it is an archive to be referred to and mined.
- Experience suggests that we need Search... search needs context... context needs detailed capture.
- There is practical value in saving as much as we can with as little overhead as possible. Utilise decades of research into Information Retrieval.

WHAT TO GATHER?

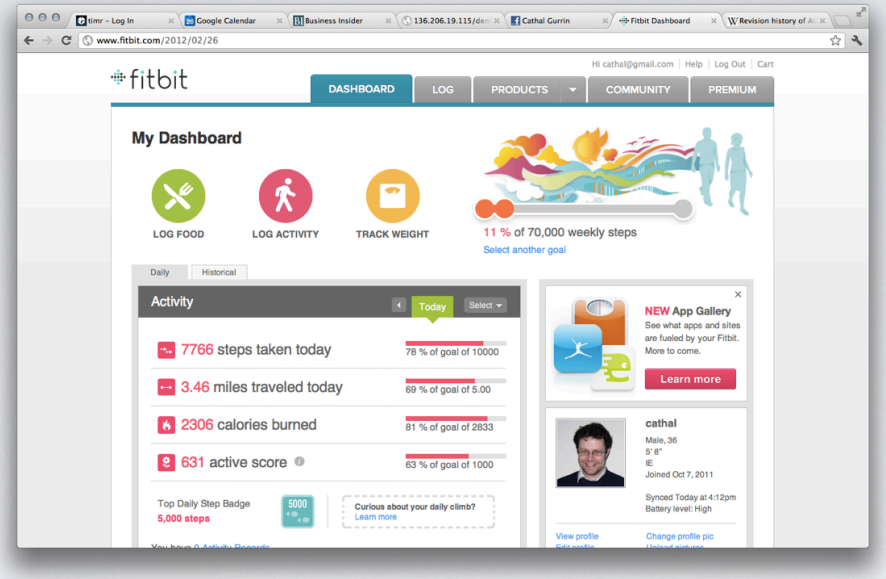
- Sensecam / Vicon Revue gathers visual archives, with other sensor data.
- For widespread use, people will likely gather other sensor data first:
  - We can learn a lot from the other sensor data: GPS, Bluetooth, Accelerometer, audio, etc...
- Society will move towards Total Capture, because the technology will be available:
  - A path that we are already on... check in an electronics store...

DAYTUM - MANUAL CAPTURE



FACEBOOK, MANUAL LIFE SHARING

OTHER EXAMPLES



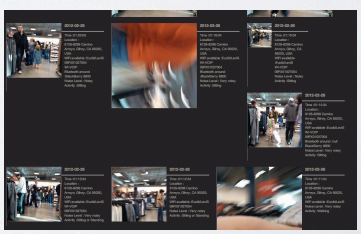
SENSECAM

- Still the standard research device
- Fisheye, PIR
- All Day
- Wonderful technical design
  - Challenge is in making this on a new device.

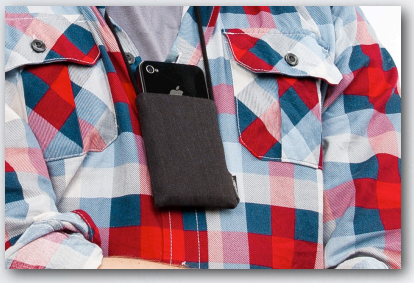
FUNF

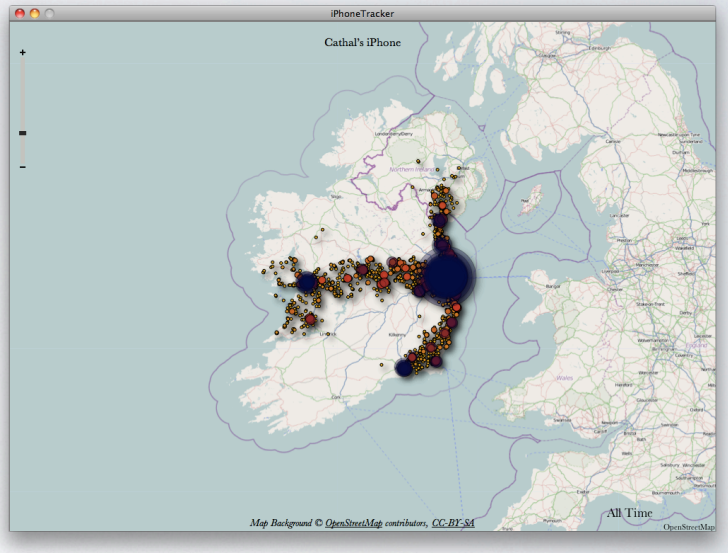
OTHER SMARTPHONE & DEVICES

- DCU SenseSeer - Realtime
- University of Southampton - See later presentation on Deja-view
- LifeLapse
- Other Phone Log software



THIS HAPPENS ALREADY

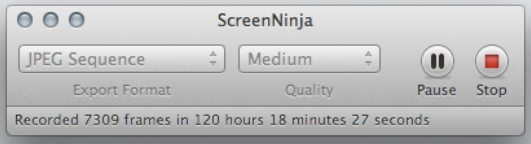




VIDEO CAPTURE

- Looxcie camera, GoPro, etc...
- Google Android glasses later this year
  - camera and screen
- Also the fusion of IR and Cameras
  - Object tracking in the real world... for €38

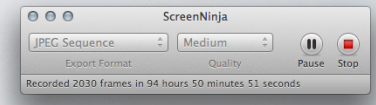
VARIOUS SENSOR DEVICES

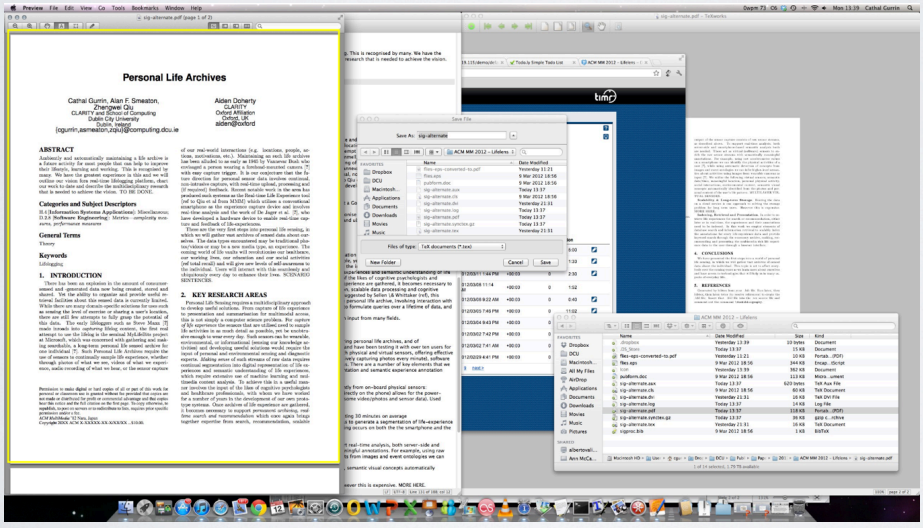


- Lijuan Zhou (later this morning) will speak about the devices in more detail, so I will not, expect to point out that I use:

INTERACTIONS WITH INFORMATION

Search my Screen





Capture as much as is sensible now. The challenge is in using a sensible and non-intrusive set of capture devices, and getting them into widespread use.

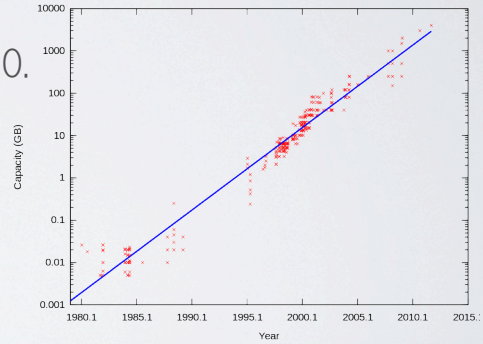
We need to show the benefits of the technology to get widespread use, but we need widespread use to unlock the unknown potential of the technology.

STORING

3

DISK ISSUES

- Kryder's Law: Magnetic disk storage densities double every 18 months; 50,000,000 fold increase since 1956.
- If true, by 2010, we can capture stereo SD video during awake hours for one year for €30.
  - 25% drop in storage costs per year per TB ; only 3% for cloud
  - Data grows by 57% per year
- Kryder's Law does not hold anymore! New tech in research phase.



STORING A LIFE ARCHIVE

- Local Storage ?
  - About €70 per TB per year; no backup; drive will fail
  - Estimate of €3,000 to store one TB forever
- Cloud Storage?
  - Amazon, about €1,300 per year + €100 to read it back
  - Dropbox, about €1,500 per year
  - Estimate of €21,500 to store one TB forever

ALL-LIFE STORES

- The question of 'forever'... how long is it?
- What happens to my data after I am gone? Digital Estates.
- What is the impact of having a digital archive that does not decay?
- Healthcare uses, social uses, education uses, organisational uses
  - We really don't know how we will use them.

The key point about storage is that at present, most people will not store their own archives. Too many security and privacy issues for personal storing. Cloud is most likely, but too costly at present... until commercial viability is figured out, or until a new technology is found.

ORGANISATION AND UBIQUITOUS ACCESS

4

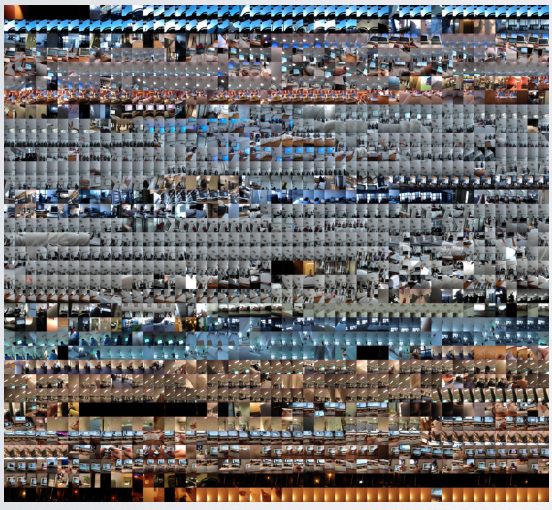
UNDERSTAND THE USES

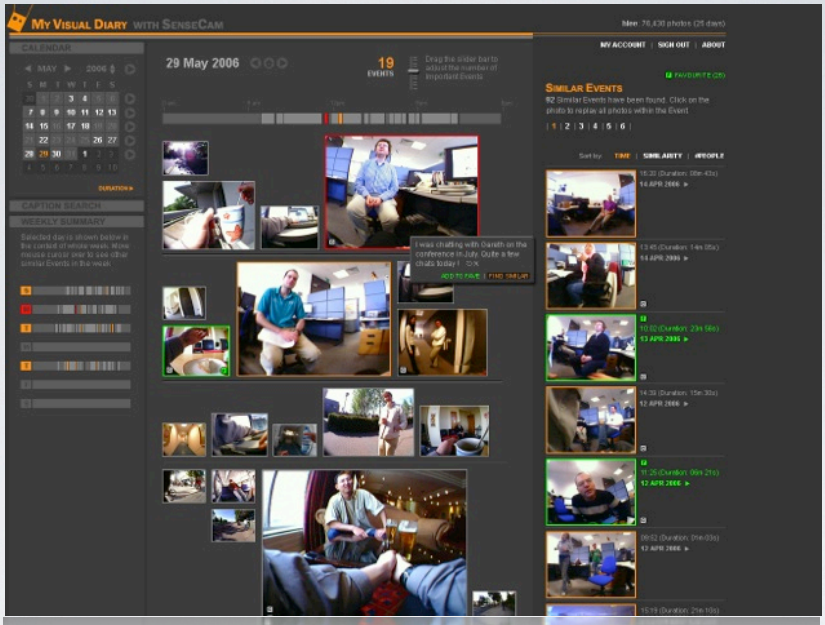
- **Reminiscence** - Sharing
- **Reflection** - Data Mining
- **Recollection** - Extraction
- **Retrieval** - Searching & Linking
- **Remembering Intentions** - Recommending Memory Cues
- All five Rs need effective search, linking and organisation technologies. That is what we are developing.

ORGANISATION CHALLENGES

- Organising archives into meaningful units (events or moments)
  - Unsure of what the ideal segmentation is.
- Automatically labeling each event (and mine knowledge from the labels)
  - This is achieved using sensors
- Identifying importance of every event.
- Facilitating Search, Recommendation and Linkage

A VISUAL LIFELOG WITHOUT EVENT SEGMENTATION

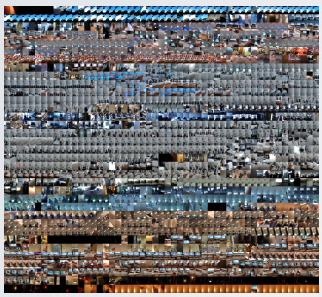


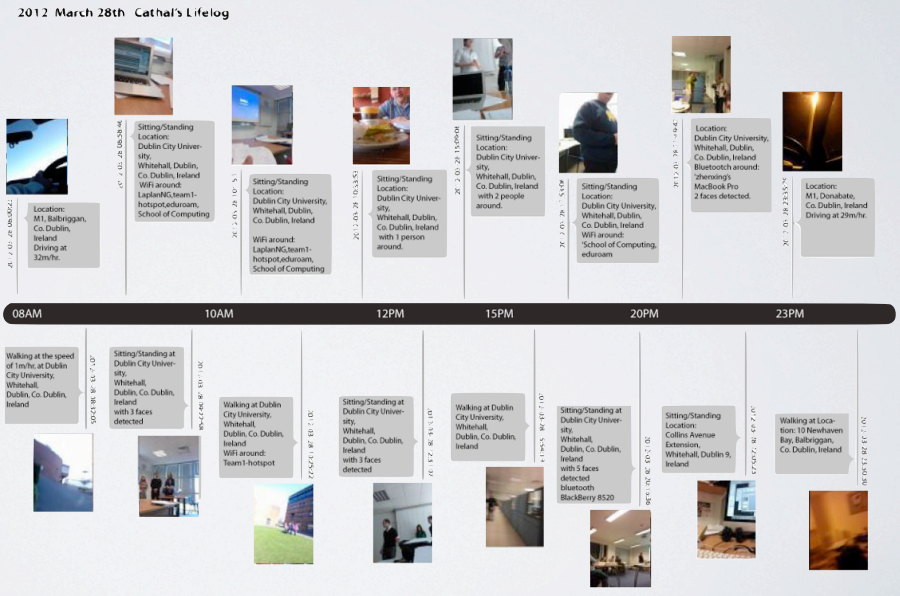


WITH EVENT SEGMENTATION

and important event & keyframe detection

WITH EVENTS & NARRATIVE GENERATION



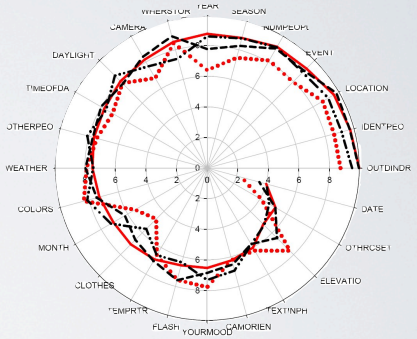


TIME TO FIND?

- Assuming Event Segmentation as a basic unit of processing
- In experimentation with Chris Moulin at the University of Leeds, over a 2.5 year archive, we found that:
  - 75% of the time we could not find an event of interest (query event)
  - It took 771 seconds on average to find an event
- So, look to Multimedia Information Retrieval for a better approach

MORE ANNOTATIONS ARE BETTER

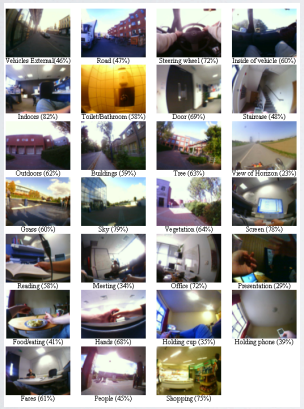
- From Multimedia Information Retrieval, we know that more axes of search helps a user to find content faster and increase recall.
- Looking to other sensor sources: location, activity, people, environment, etc..
- More axes of search, the easier to find an event, or link between events, or recommend events.



"Context data in geo-referenced digital photo collections", Naaman et. al. '04

WHAT AXES OF SEARCH?

BASED ON AUTOMATIC ANALYSIS OF SENSORS!



Location: Physical, logical, social, relative location, pathways inside buildings
People: who is nearby, what social relationship, integrate face detection, integrate face recognition.
Date/Time: relative time, season, day, light-status
Activity: physical actions, energy expenditure
Noise: environment identification
Objects in view: screen, steering wheel, vehicle, face, people, hands, roads, stairs, doors.
Action identification: reading, drinking, eating, shopping, teaching, meeting, holding phone
Scenes/Setting Identification: indoor, outdoor, office, shopping mall, bathroom, city/buildings, vegetation/countryside, inside vehicle, sky view

CLUES ABOUT IMPORTANT ACTIVITIES

1	2	3	4
Intimate relations	Socializing	Relaxing	Pray/worship/meditate
5	6	7	8
Eating	Exercising	Watching TV	Shopping
9	10	11	12
Preparing food	On the phone	Napping	Taking care of Children
13	14	15	16
Computer/Internet	Housework	Working	Commuting

Important Activities in decreasing order of enjoyment

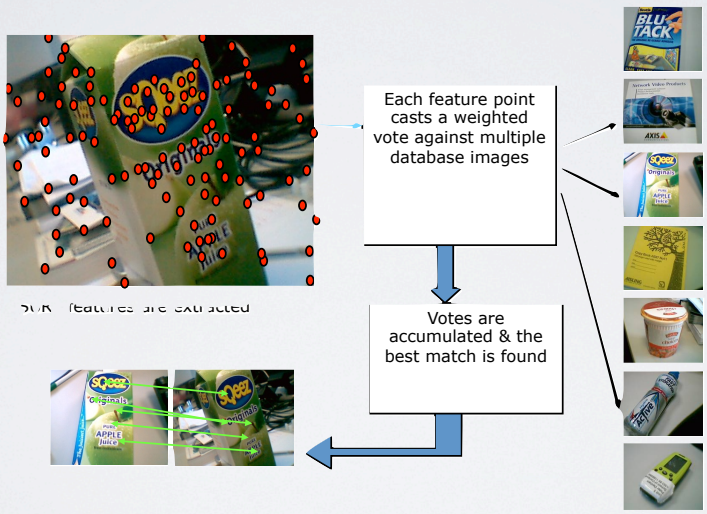
Kahneman et al. A survey method for characterizing daily life experience: The day reconstruction method. Science, 306(5702):1776–1780, 2004.

TIME TO FIND?

- Assuming Event Segmentation as a basic unit of processing and multi-axes of search
- Continuing our experimentation with Chris Moulin on the same 2.5 year archive, we found that:
  - 75% of the time we could find an event of interest (query event)
  - It took 121 seconds on average to find an event
- We need to define the axes that we can support, and develop systems with a view to supporting additional axes.

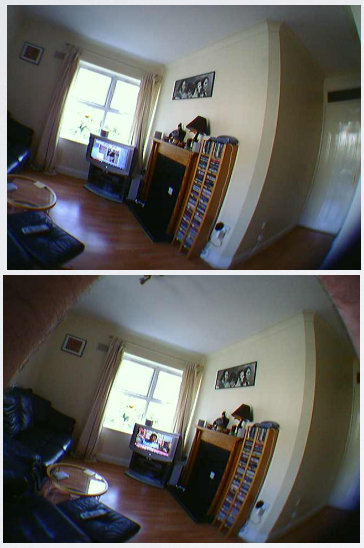
SEEN IT BEFORE... SOMEWHERE

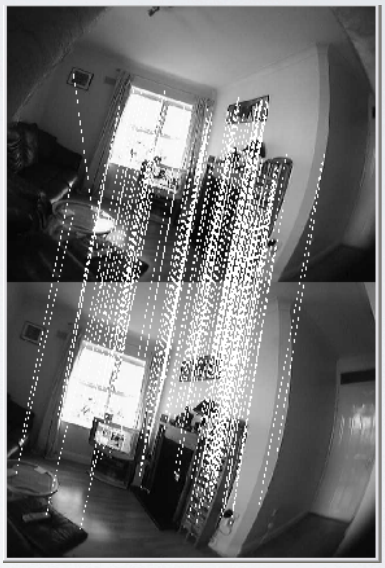
OBJECT MATCHING



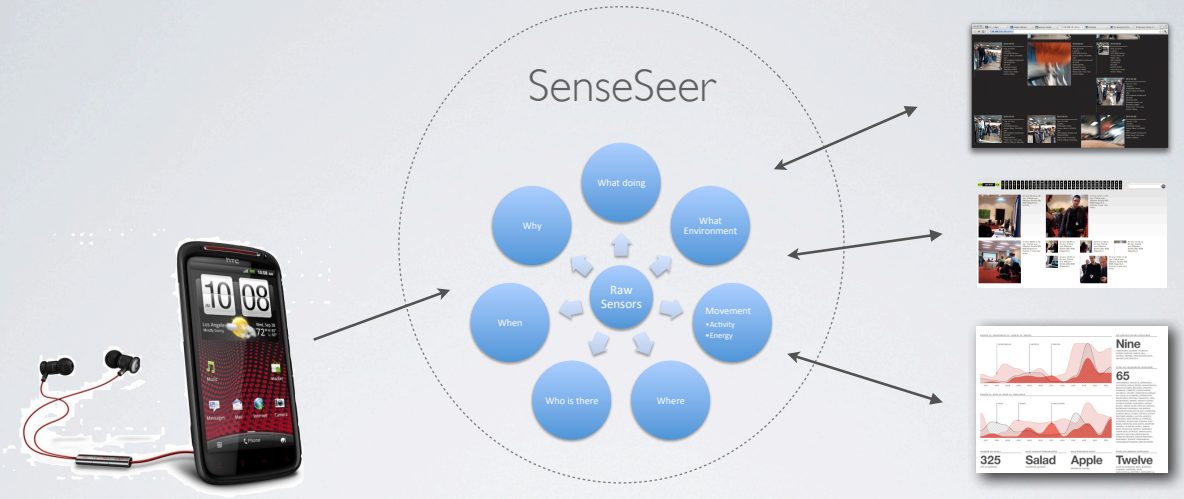
BEEN HERE BEFORE... SOMETIME

SCENE MATCHING





Tying all this together, we are developing the SenseSeer Lifelogging platform



SENSESEER PLATFORM

Real-time, lifelogging with Sharing

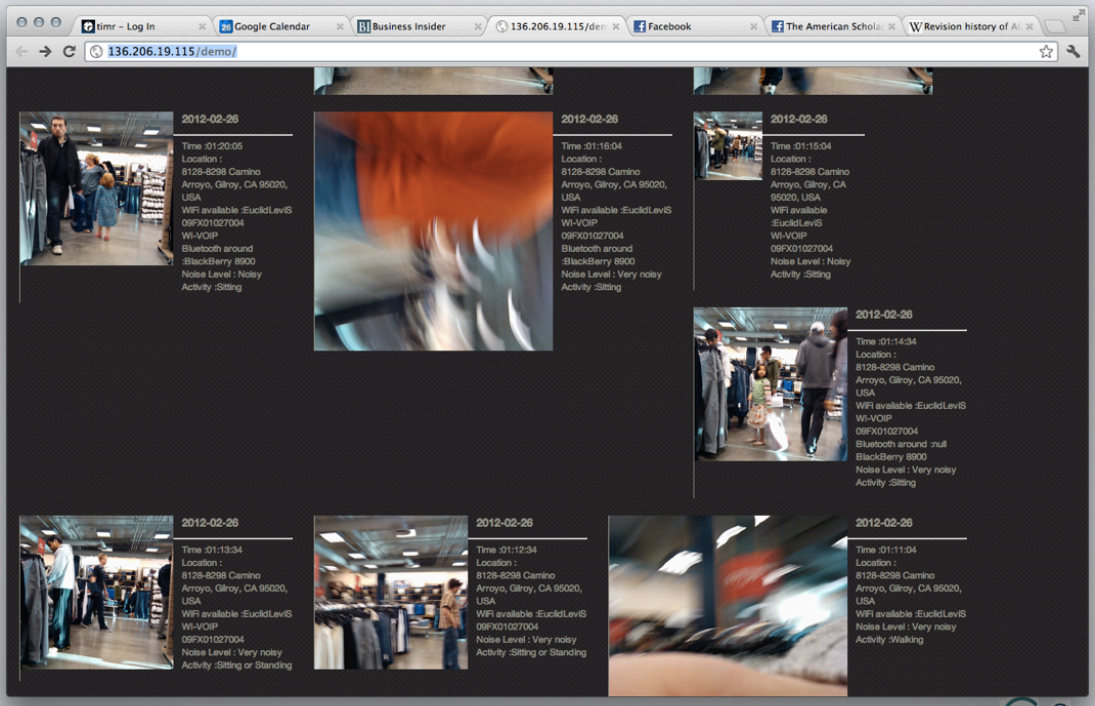
SenseSeer
Creating Knowledge from Your Data

SENSESEER

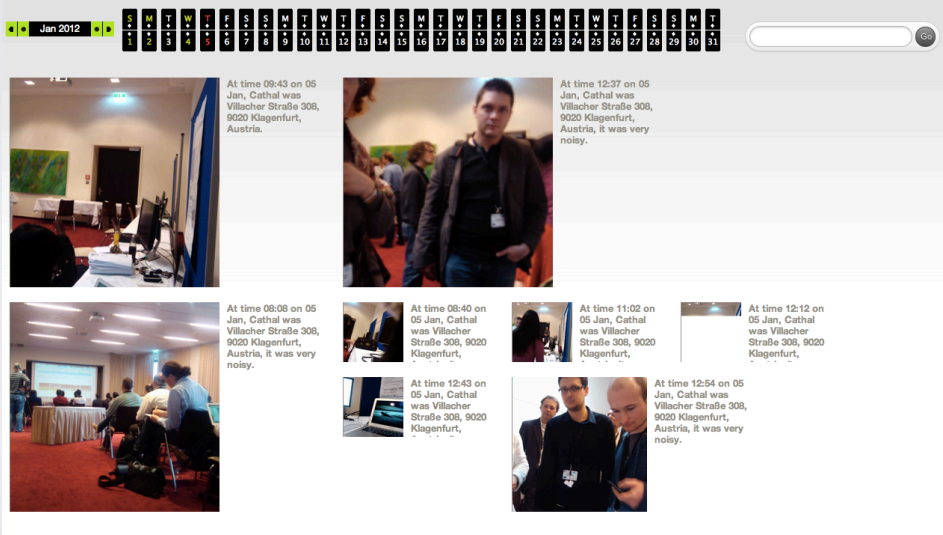
- Smartphone & Cloud based Lifelogging platform. All day logging (just like a sensecam), but more sensors, more context and real-time upload.
- Default features include event segmentation, knowledge extraction for annotation & search, digital diary interface and summary information generation.
- Designed with the five Rs in mind, to support: sharing (*Reminiscence*), data mining (*Reflection*), image processing and analysis (*Recollection*), Searching & Browsing (*Retrieval*) and context sensitive recommendation of memory cues (*Remembering intentions*).
- Extensible using APIs.
- We are seeking people to suggest new uses and software sensors.

SenseSeer
Creating Knowledge from Your Data

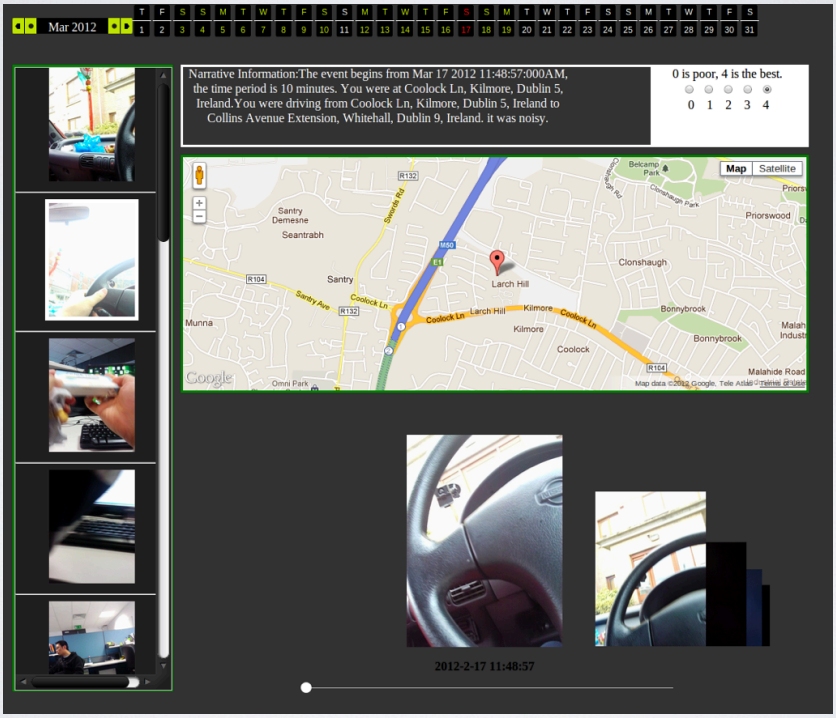
REAL-TIME UPLOAD



REAL-TIME EVENTS

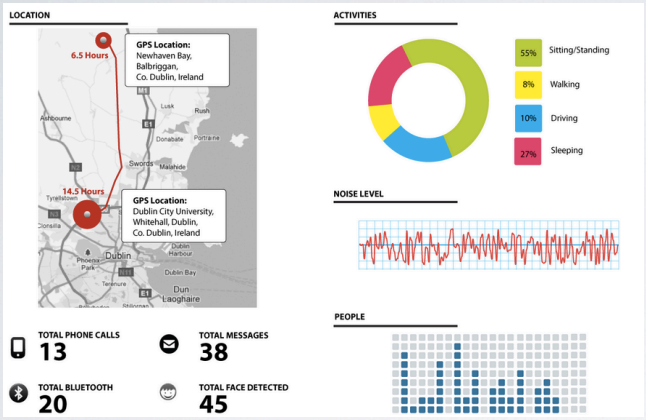


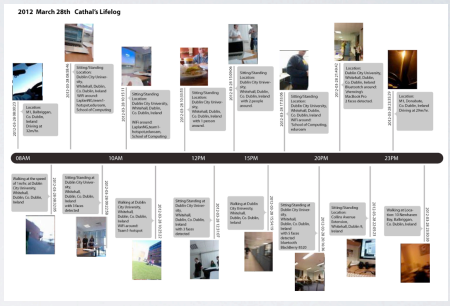
TEXTUAL NARRATIVES

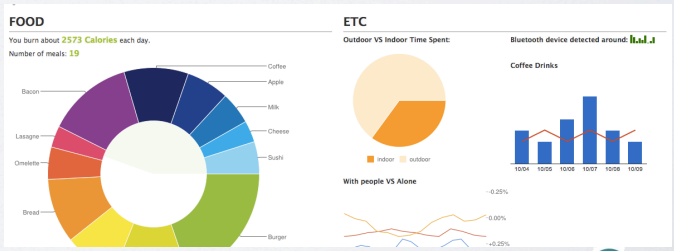


SenseSeer
Creating Knowledge from Your Data

VISUAL SUMMARISATION







SenseSeer
Creating Knowledge from Your Data

Segmentation into events, or something akin to events is important.

We need to gather a lot of sensed data and analyse it to derive meaning. This meaning is then the source for supporting search and recommendation, as well as for interfaces.

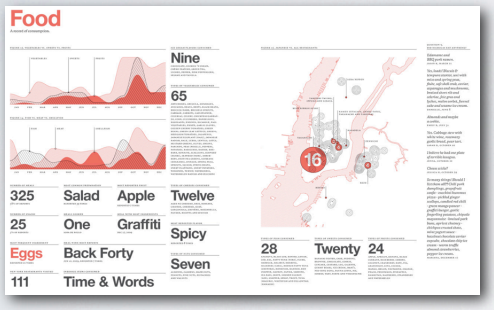
It is a huge search challenge that we are not near solving yet. Google can search tens of billions of documents in less than a second.

INTERFACE & APPLICATION

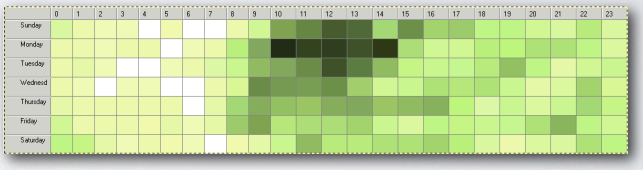
5

LIFE VISUALISATIONS

Nick Feltron Annual Reports

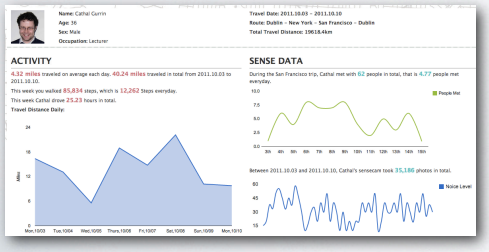


My Social Interactions



The best times to break into my home

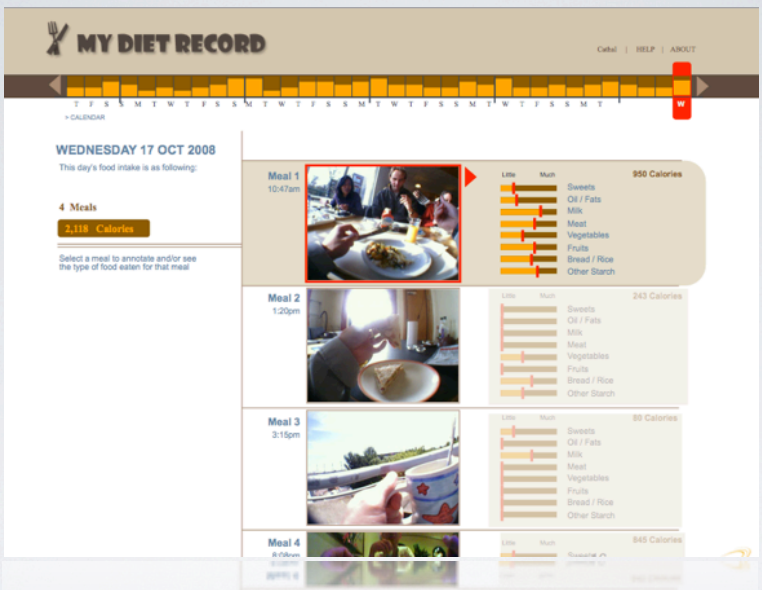
SenseSeer Infographics



WEEK SUMMARIES

using a 5000x2000 touchscreen

COMIC-BOOK INTERFACE



INTERFACE FOR PERSONAL HEALTHCARE

diet monitoring, exercise, fitness, etc...

TV INTERFACE

with Gesture Control

CONCLUSION

This is happening now.
Lets work together to develop meaningful technologies.

Eat your own dog food...

Thanks to the DCU team and our collaborators!
Aiden Doherty, Alan Smeaton, Zhengwei Qiu, Niamh Caprani, Lijuan Zhou, Yang Yang, Peng Wang, a host of other PhDs and interns. Also Vicon and Microsoft Research.

THANK YOU FOR LISTENING

cathal@gmail.com

http://www.computing.dcu.ie/~cgurrin/

Any Questions?