

# VK Multimedia Information Systems

Mathias Lux, [mlux@itec.uni-klu.ac.at](mailto:mlux@itec.uni-klu.ac.at)

# Agenda



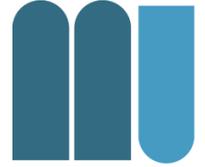
- Topics & goals
- Modalities & examination
- Schedule
  
- What is **information**?
- What are **information systems**?
- The information overload
- Current state in *MuMe* consumption

# C.V.



- Technische Mathematik an der TU Graz
- Doktoratsstudium Telematik
- 98-01 Entwicklung von Web-Applikationen
- 01-06 Know-Center in Graz (KPlus)
- 05-06 Ass. am KMI / TU Graz
- 06- ... Ass. am ITEC / Uni Klagenfurt

# Course Topics



Multimedia Databases

Multimedia Management

Social Media Sharing

Video Analysis

**Metadata**

Data Mining

Digital Audio

**Information Retrieval**

Social Networks

**Image Processing**

Retrieval Evaluation

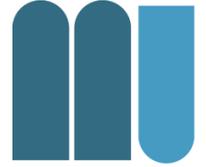
# Goals I



Basic (and a little more) understanding of

- Multimedia retrieval
- Multimedia analysis
  - images in the spatial domain
  - audio & video processing
- Multimedia databases & meta data

# Goals II



- Overview on state of the art
  - who is who in research
  - what to read if I want to know more?
  - available tools in development
  - de facto & de jure standards

# Goals III



- Providing a solid base for
  - further research,
  - consulting and
  - practical development
- in the area of
  - multimedia information retrieval
  - multimedia information systems
- and: hands on experience!

# Modalities



Multimedia Information Systems ist eine  
*„prüfungsimmanente Lehrveranstaltung“*

A positive grade is based on

- some few mandatory exercises / readings
- ongoing collaboration
- a mid term and a final project

# Modalities



## Mid term projects are

- The same for everyone
- A simple VIR system + evaluation

## Final projects are

- Practical implementations of MMIS
- Research work & studies

## Projects topics will be

- ... assigned after Easter holidays
- ... assigned to groups or individual students

# Team Work



- Preferably teams of 2 students
- TEAM = „Toll-Ein-Anderer-Machts“ ?



# Projects



- Topics:
  - Scenic View Finder
    - Android image search application
  - Lire Web demo
    - Web based demo of Lire features
  - Additions to Lire
    - Extension of the existing library, eg. JNI wrappers for OpenCV, face detection based on OpenIMAJ etc.
  - Near duplicate search in PDF images
    - Tracking the use of assets in documents
  - or: Bring along you own Topic

# Grades



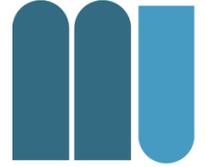
Grade is derived from:

- **1/4 Exercises**
  - Pen & paper
  - Readings
- **1/2 Project**
  - ¼ each
  - Implementation
- **1/4 Presentation**

<http://www.xkcd.com>



# Schedule



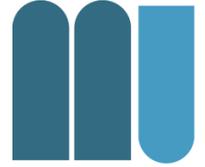
- Introduction, motivation, information theory & systems
- Information retrieval
- Web based IR, PageRank, HITS
- Network analysis & social networks (guest lecture)
- Multimedia meta data
- Image analysis and content based image retrieval
- Audio & sound analysis
- Video information systems
- Multimedia databases

# Questions?



Any questions regarding organizational issues left?

# Agenda



- What is **information**?
- What are **information systems**?
- The information overload
- Current state in **MuMe** consumption

# What is Information?



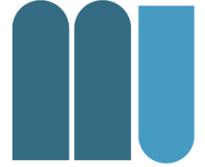
## Definition of Aamondt and Nygard (1995) :

- Data
- Information
- Knowledge

*Aamodt, A. & Nygard, M. "Different roles and mutual dependencies of data, information, and knowledge - an AI perspective on their integration" Data Knowl. Eng., Elsevier Science Publishers B. V., **1995**, 16, 191-222*

# Data

Aamondt und Nygard (1995)



*Data are syntactic entities*

- Patterns without meaning
- Input to an interpretation process

Example:

- Bits & Bytes of a JPEG encoded image

# Information

Aamondt und Nygard (1995)



*Information is interpreted data*

- Information is data with meaning
- Output from interpretation
- Input to knowledge based process

Example:

- Decoded (and displayed) JPEG image

# Knowledge

Aamondt und Nygard (1995)



*Knowledge is learned information*

- Incorporated in an agents (software / human) reasoning resources
- Ready for active use
- Output of learning process

Example:

- There is a dog shown on the JPEG image

# What is Information?



## Definition of Zeleny (1987):

- Data
- Information
- Knowledge
- Wisdom

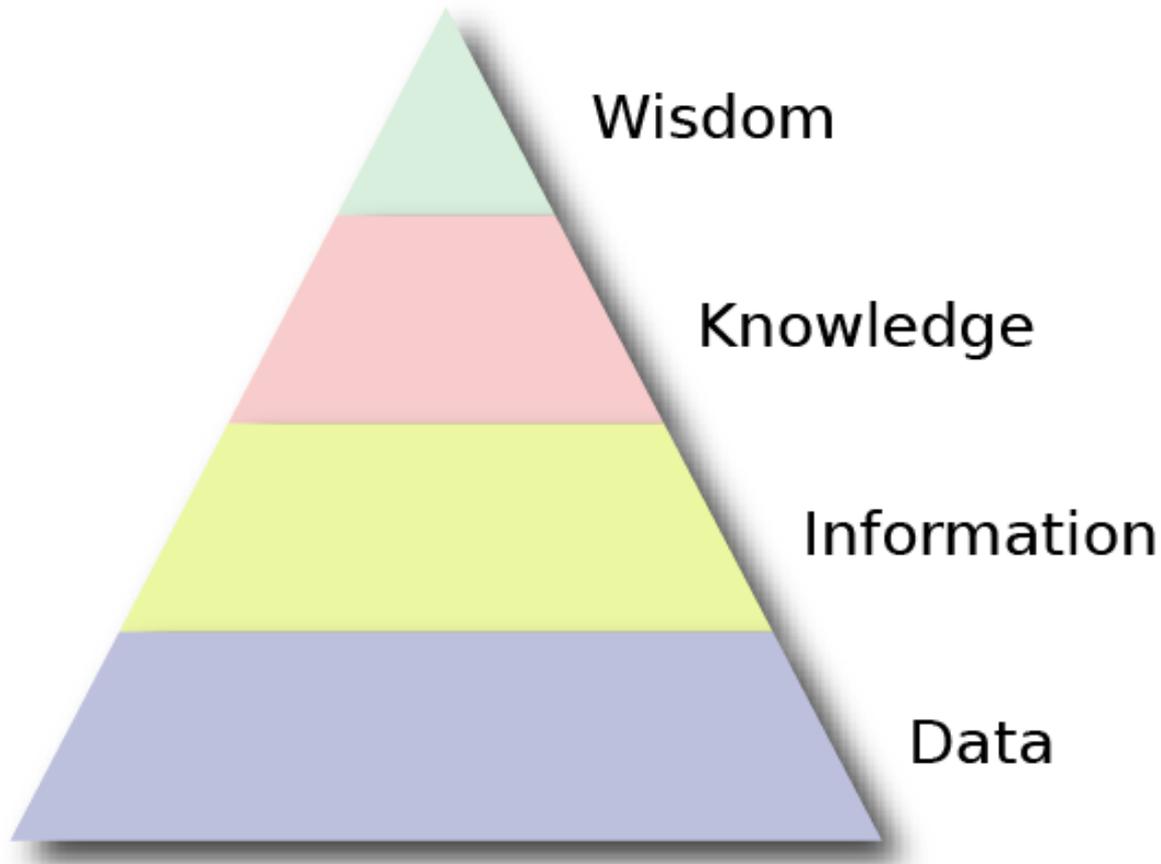
*Zeleny, M. "Management Support Systems: Towards Integrated Knowledge Management" Human Systems Management, 1987, 7, 59-70*

# What is Information?



Image originally published in the December 1982 issue of *THE FUTURIST*, taken from [http://www-personal.si.umich.edu/~nsharma/dikw\\_origin.htm](http://www-personal.si.umich.edu/~nsharma/dikw_origin.htm)

# The DIKW Hierarchy



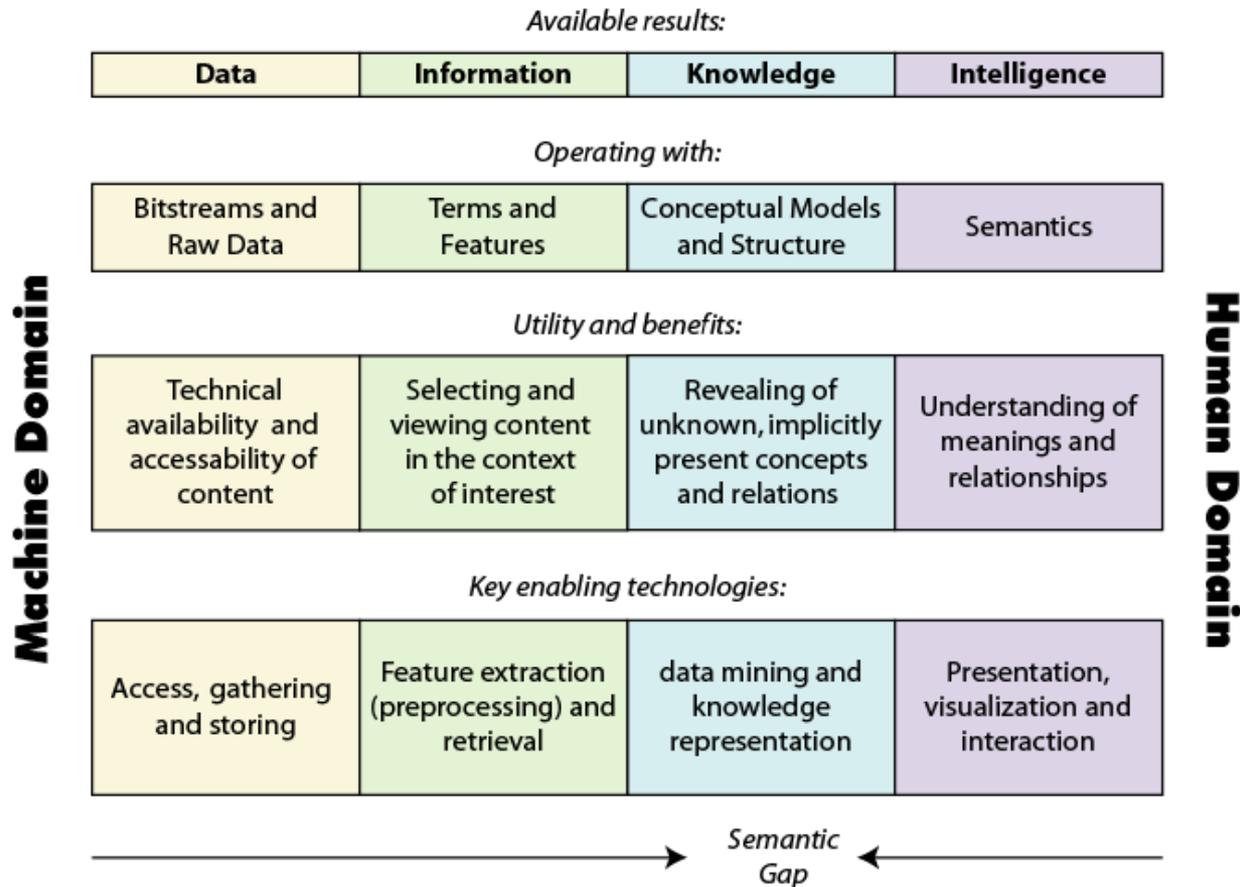
# The DIKW Hierarchy



Definition of the DIKW levels:

Data	Know nothing
Information	Know what
Knowledge	Know how
Wisdom	Know why

# Modified DIKW (IBM)



# What is Information?



## Shannon's information theory

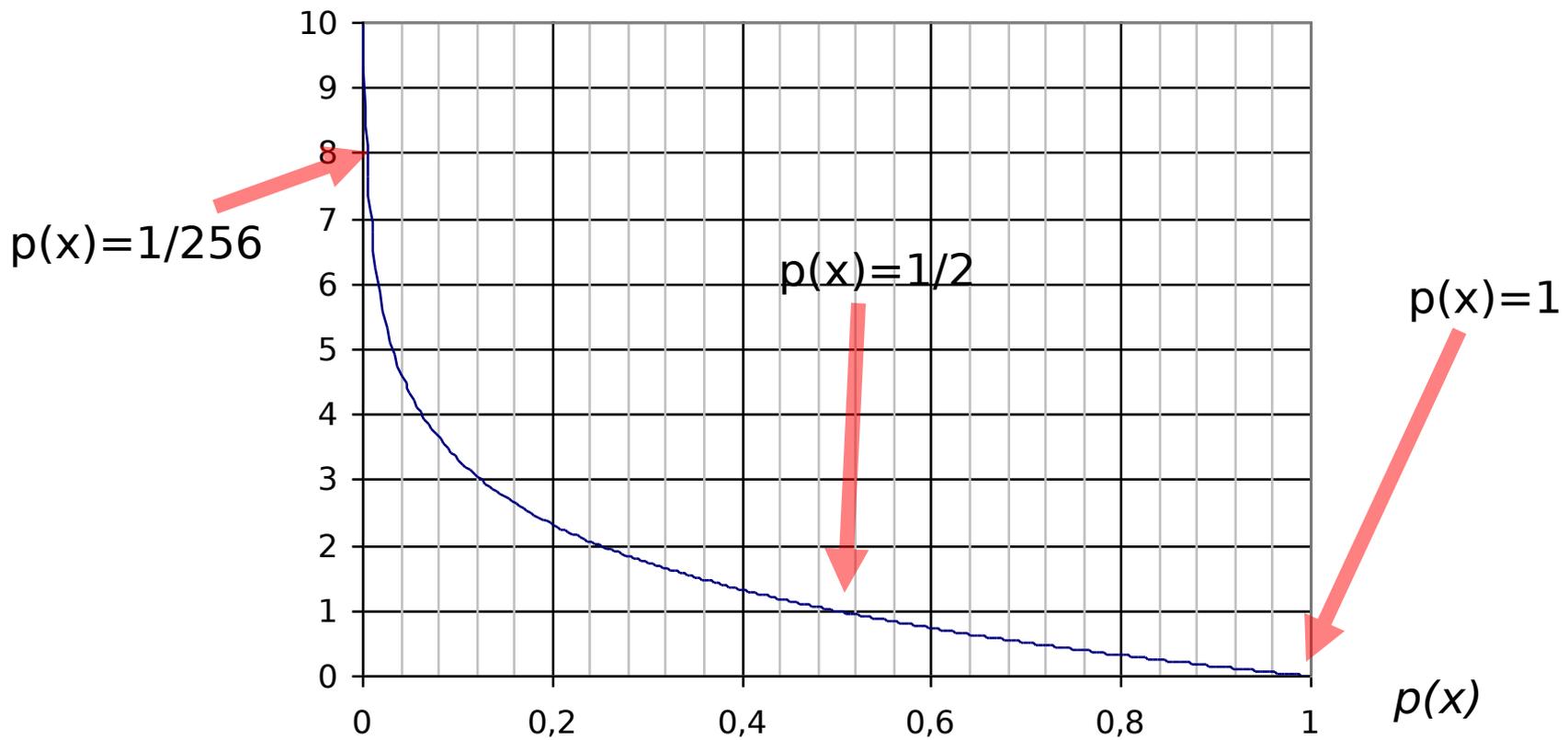
- Problem: communication over a noisy channel
- Fundamental finding:
  - Information content (measured in bits) of an event (e.g. letter) depends on the entropy (probability of occurrence)

$$I(A_n) = \log_2 \left( \frac{1}{P(A_n)} \right) = -\log_2(P(A_n))$$

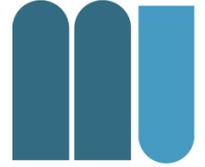
# Shannon's Information Theory



Anzahl der Bits



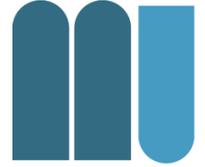
# Grice's Maxims of Conversation



- As informative as required
- As correct as possible
- Relevant to the aims of the conversation
- Contribution should be clear, unambiguous and concise

*Hauptmann, A. G. & Witbrock, M. J. "Story Segmentation and Detection of Commercials in Broadcast News Video" ADL '98: Proceedings of the Advances in Digital Libraries Conference, IEEE Computer Society, 1998*

# Agenda



- What is information?
- What are **information systems**?
- Information overload
- Current state in **MuMe** consumption

# What are Information Systems?



- Systems for handling information
  - collect, store & organize
  - process, disseminate & transmit
- Three main parts in these systems
  - people,
  - machines &
  - methods

# MEMEX



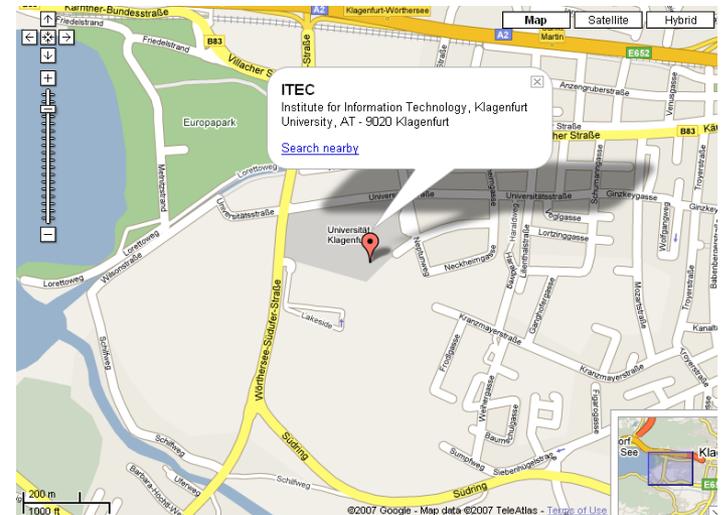
## Memory Extender - Vannevar Bush

- Published in 1945 (Atlantic Monthly)
- An electromechanical device for
  - viewing books and films
  - adding information and comments
  - interlinking information
  - browsing links
- MEMEX is an early hypertext system

# Geographic IS



- Focus on **spatially referenced data**
  - coordinates, height
  - distance, inclusion, neighboring
  - hierarchical organization



*taken from Google Maps*

# Multimedia IS



- Focus on multimedia data & meta data
  - storage, transmission
  - search & retrieval
  - organization & dissemination
- Media types
  - textual / visual / auditive / haptic / olfactory
  - rastered or rendered / modelled
    - Midi vs. MP3
    - VRML vs. PNG
    - LASER vs. MPEG-2

# Agenda



- What is information?
- What are information systems?
- Information overload
- Current state in MuMe consumption

# Information Overload



- 5 Exabytes of new information in 2002.
  - 92% of the new information was stored on magnetic media, mostly in hard disks.
  - that's 800 MB per person on the globe
  - that's 37.000 times the LoC
  - that's 30% more than in 1999

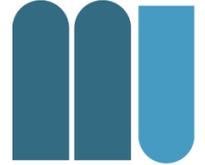
*Lyman, Peter and Hal R. Varian, "How Much Information", 2003. Retrieved from <http://www.sims.berkeley.edu/how-much-info-2003> on [2007-02-07]*

# Information Overload



- 18 Exabytes of new information in information flow in 2002
- 98% of new information generated by phone calls
  - Most radio and TV broadcast content is **not new information**.
    - ~ 70 out of 320 million h of radio is new, that's 3.500 TB
    - ~ 31 out of 123 million h of TV are new, that's 70.000 TB

# Information Overload



## Information Flow (ctd.)

- IM: 5 billion messages / day or 274 TB p.a.
- Email: 400.000 TB p.a.
- P2P: growing, but not yet estimated,
  - significant traffic has been observed on different backbones
  - Ranges from 20%-60% are mentioned

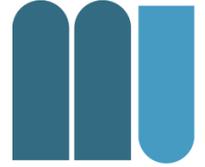
# Information Usage



An average American adult:

- Telephone - 16.17 hours a month
- Radio - 90 hours a month
- TV - 131 hours a month
- 53% of the U.S. uses the Internet
  - ~ 25.5 h / month at home
  - ~ 74.5 h / month at work

# Agenda



- What is information?
- What are information systems?
- Information overload
- Current state in MuMe consumption

# Current State in MuMe Consumption



- Digital photography
  - still images
- Digital video in general
  - streaming and download

# Digital Imaging Devices (global)



- First question: how many devices exist?

Device	# in 2006
digital cameras	400 * 10 <sup>6</sup>
camera phones	600 * 10 <sup>6</sup>

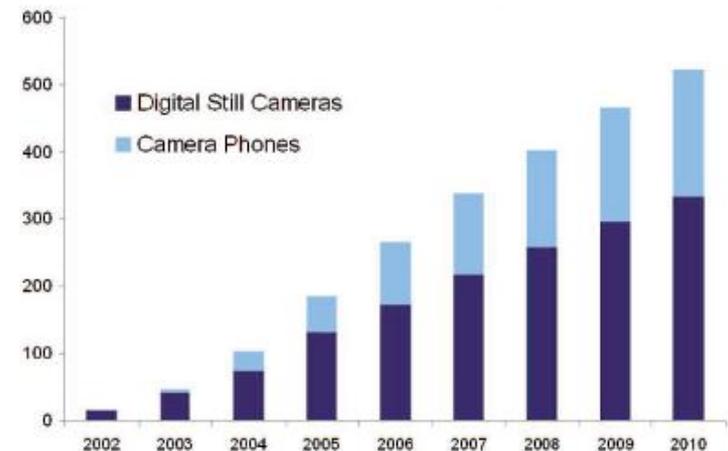
Source: IDC Study "Expanding Digital Universe"  
[http://www.emc.com/about/destination/digital\\_universe/](http://www.emc.com/about/destination/digital_universe/)

# Number of Digital Photos (global)



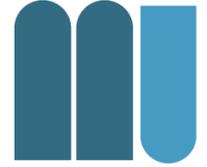
- Estimate 2006
  - > 150 billion photos from cameras
  - > 100 billion photos from camera phones

- Forecast 2010
  - > 500 billion photos
  - + increased resolution

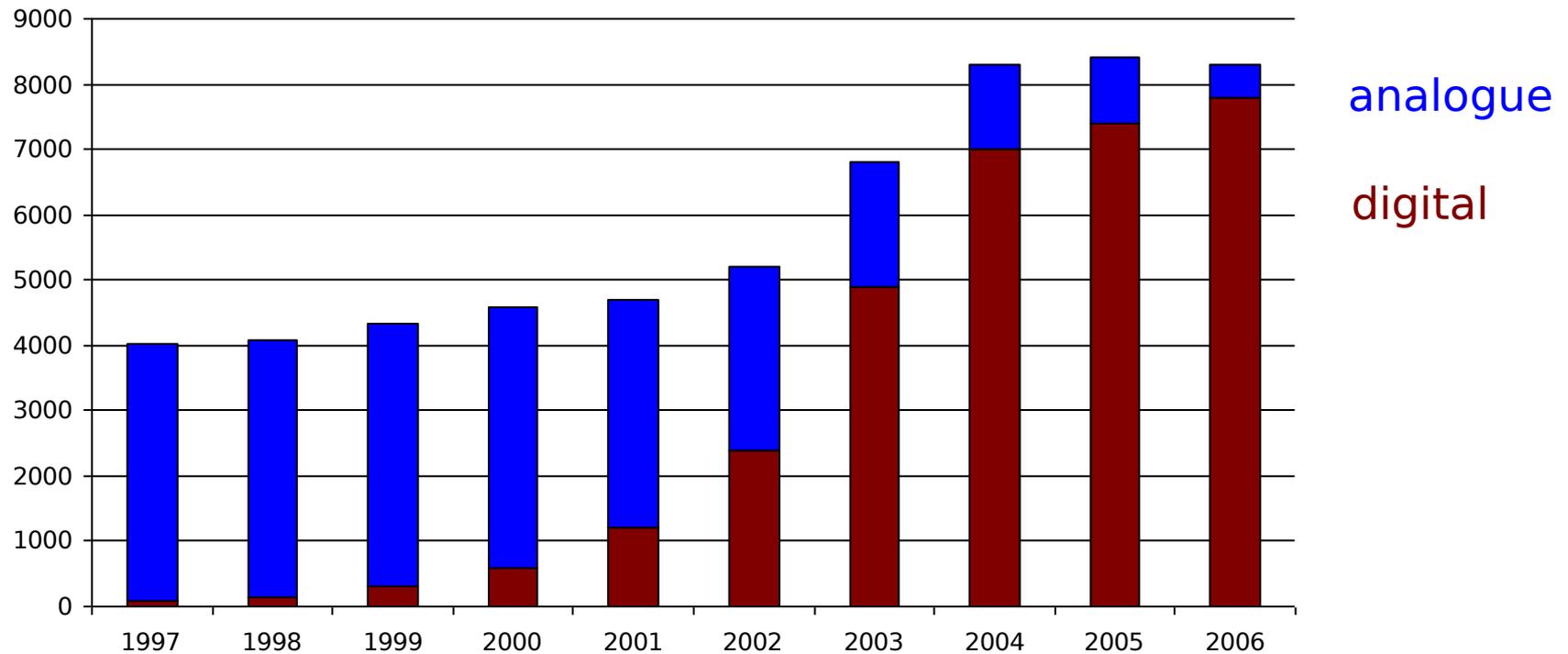


Source: IDC Study "Expanding Digital Universe" [http://www.emc.com/about/destination/digital\\_uni](http://www.emc.com/about/destination/digital_uni)

# Digital Imaging Devices (Germany)



## Still image cameras sold in Germany (thousands)

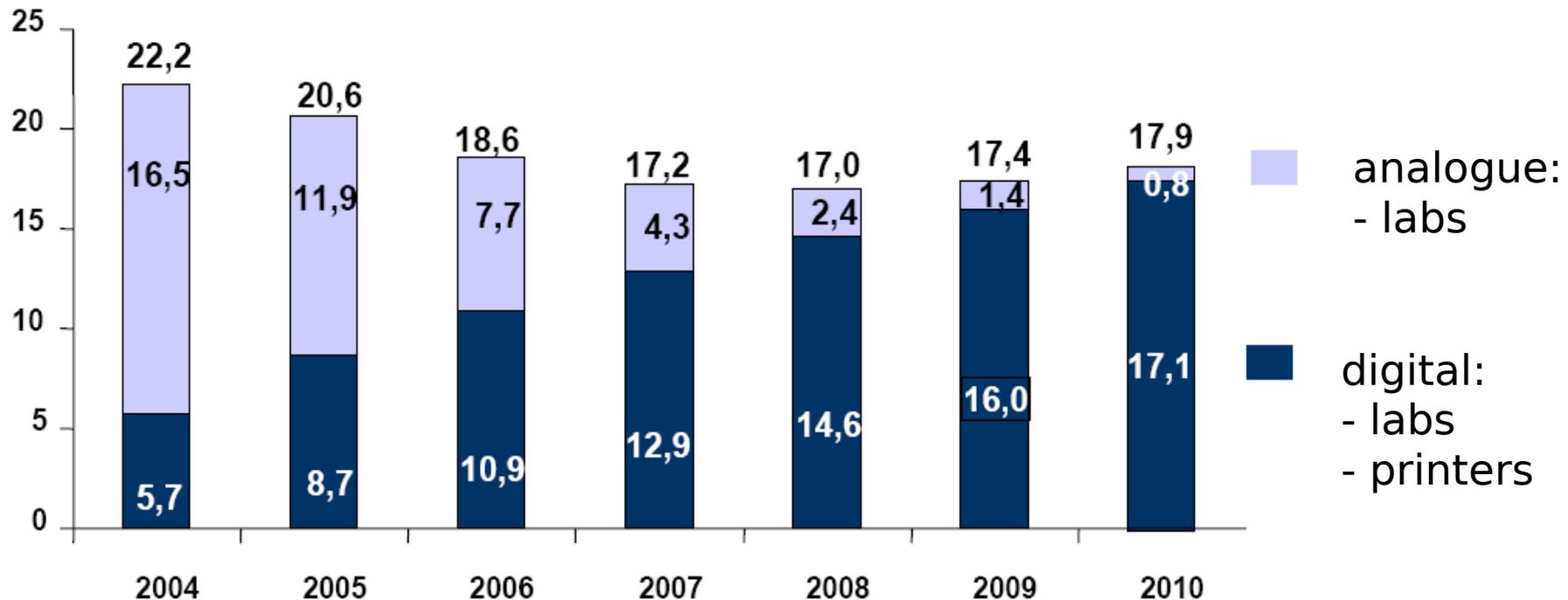


Source: Cewe Factbook, <http://www.cewecolor.de>

# Photo prints market (Western Europe)



- Photo prints forecast (in billions)

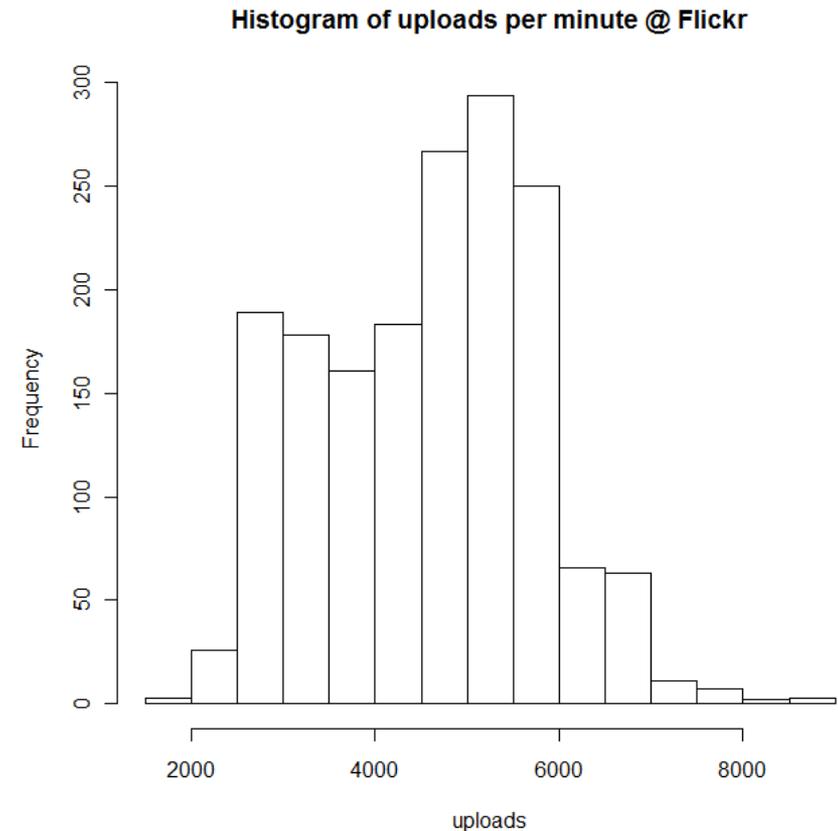


Source: Cewe Factbook, <http://www.cewecolor.de>

# Flickr



- 3 billionth upload in November 2008
- Currently ~4,800 uploads per minute

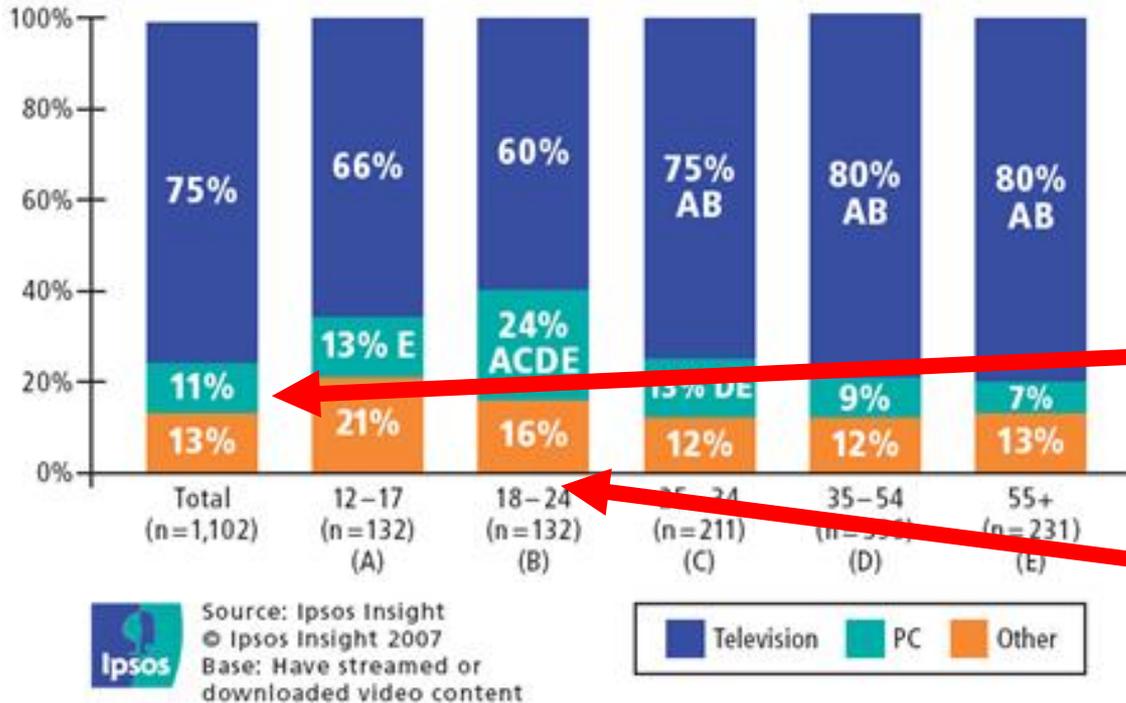


# Content



- What is information?
- What are information systems?
- Information Overload
- Current state in *MuMe* consumption
  - digital photography
  - digital video in general

# Where video content is watched? (US, 2007)



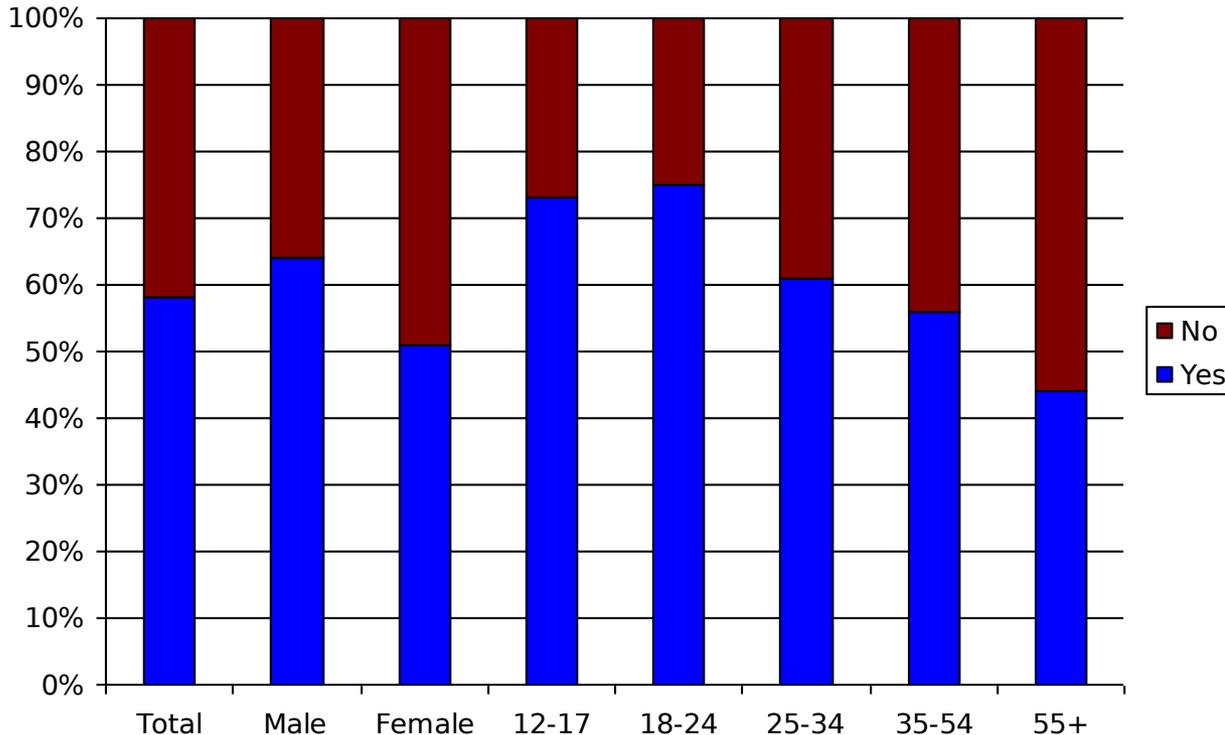
- Among people having downloaded / streamed content

11% in total watched on PC

24% in age 18-24

Source: Ipsos Insight's 2007 MOTION Study - <http://www.ipsosinsight.com/pressrelease.aspx?id=3500>

# Ever Streamed a File Off of the Internet? (US, 2007)



- 75% of the 12-24 years old.
- More than half in total.

Source: Ipsos Insight's 2007 MOTION Study - <http://www.ipsosinsight.com/pressrelease.aspx?id=350>

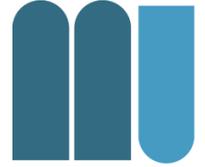
# Short vs. Long Clips (US, 2007)



- Short clips are preferred
  - 3/4 of streamers have streamed short news or sports clips
  - 2/3 of streamers have streamed amateur or homemade clips
- Also due to YouTube ...
  - 40% of the streamers use YouTube
  - Common restrictions in video size & length

*Source: Ipsos Insight's 2007 MOTION Study - <http://www.ipsosinsight.com/pressrelease.aspx?id=350>*

# Most Common Barriers for payed DLs (US, 2007)

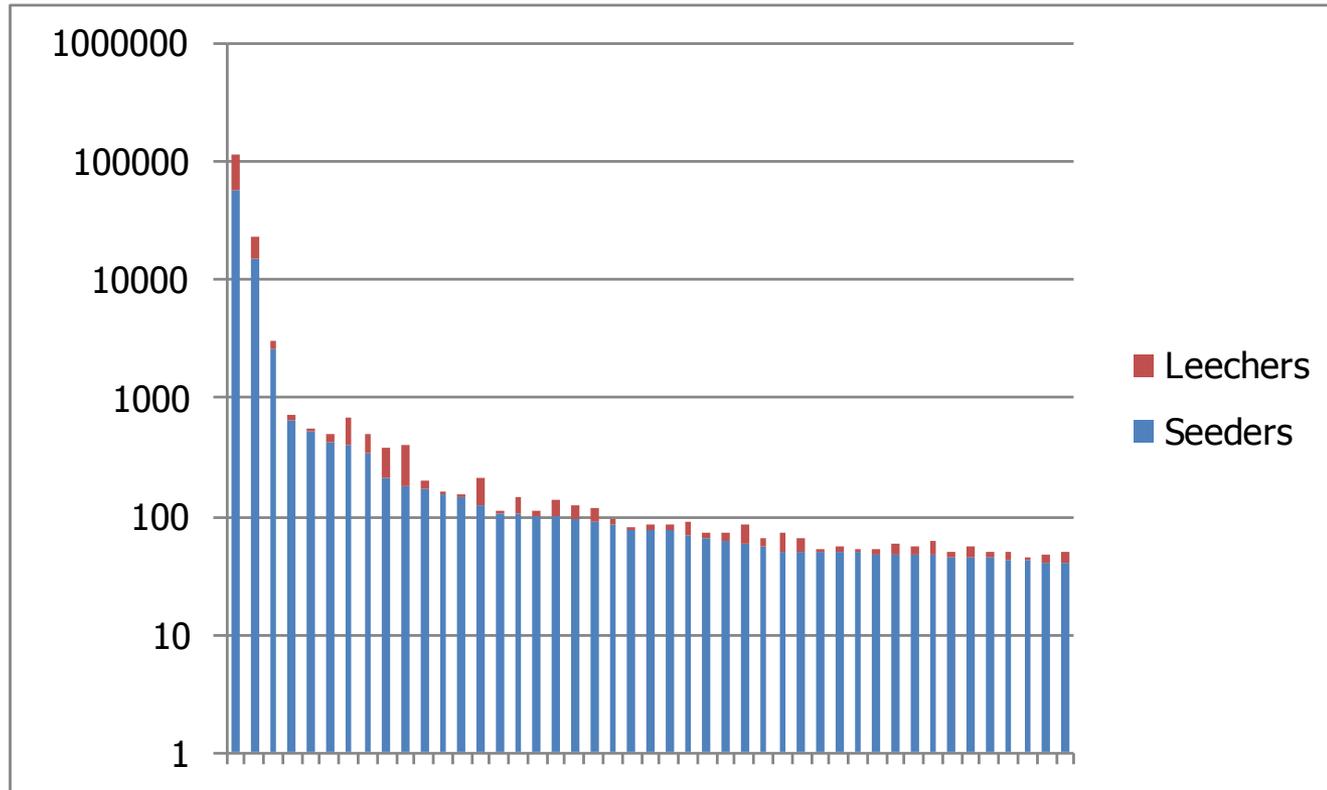


- Unwillingness to pay for this content,
- Difficulty or inability to
  - burn these files onto DVD
  - watch this content on their living room TV.

But there are also benefits in the future:

- 24/7 access
- reasonable fees or free (ad supported)

# Bittorrent Movies (*query: jaybob, 2011-03-08*)



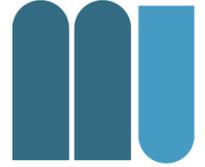
# Bittorrent Movies

## (query: jaybob, 2011-03-08)



	Seeders	Leechers
Toy Story 3.DVDScr.XviD-Jaybob	58805	58814
Due Date {2010} DVDRIP. Jaybob	15369	8372
Knight And Day 2010 DVDRip Xvid-Jaybob	2625	479
Killers {2010} DVDRIP Jaybob	658	60
Marmaduke {2010} DVDRIP. Jaybob	519	37
Why Did I Get Married Too ? [2010] DVDRIP Jaybob	435	52
Main Street {2010} DVDRIP. Jaybob	404	290
The Fourth Kind {2009} DVDRIP jaybob	348	147
Inhale {2010} DVDRIP. Jaybob	213	167
TRON Legacy {2010} DVDRIP Jaybob	177	224
Dog Pound [2010] DVDRIP XVID Jaybob	170	27
The Karate Kid 2010 DVDRIP Jaybob	155	9
The Joneses {2009} DVDRIP Jaybob	143	15
How To Make Love To A Woman {2010} DVDRIP. Jaybob	127	87
Nanny McPhee Returns {2010} DVDRIP Jaybob	107	6
The Tournament {2009} DVDRIP Jaybob	105	43
Batman Under the Red Hood {2010} DVDRIP Jaybob	103	6
Basement [2010] DVDRIP XVID Jaybob	101	34
My Sister's Keeper {2009} DVDRIP Jaybob	94	31
Trick R Treat {2009} DVDRIP Jaybob	92	23
Twelve {2010} DVDRIP Jaybob (unrated)	87	6
A Nightmare On Elm Street {2010} DVDRIP Jaybob	79	3

# Getting started with Lire



- Check if already have Java installed
  1. On windows open a command prompt
    - e.g. by hitting the Windows key and the “r” key at the same time and entering ‘cmd’ into the pop-up
  2. Type in ‘java -version’ and you should see something like this:

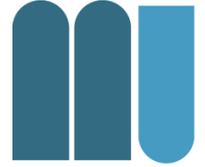
```
C:\Temp>java -version
java version "1.6.0_23"
Java(TM) SE Runtime Environment (build 1.6.0_23-b05)
Java HotSpot(TM) 64-Bit Server VM (build 19.0-b09, mixed mode)
```

# Getting started with Lire



- If
  - you do not have Java installed or
  - the version is smaller than 1.6.0,
- then
  - you need to download and install Java
- Download & install Java
  - JDK recommended
  - <http://www.oracle.com/technetwork/java/javase/downloads/index.html>

# Getting started with Lire



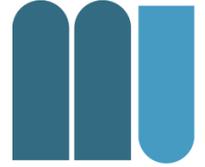
- Download & install Java
  - Using the JDK (instead of JRE) recommended
  - The JDK includes all development tools
  - <http://www.oracle.com/technetwork/java/javase/downloads/index.html>

# Download & Install LireDemo

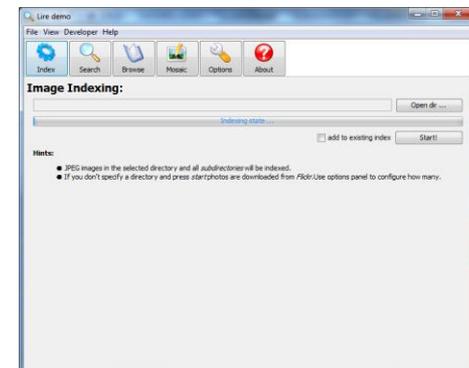


- Download the most recent version of LireDemo
  - <http://sourceforge.net/projects/caliph-emir/files/Lire/>
- Unzip the files to a directory of your choice

# Run LireDemo



- Start LireDemo by
  - Either double click on the file “Liredemo.jar”
  - Or by typing in “java -jar LireDemo.jar” in the command prompt.
- Either way a window like this one should appear:

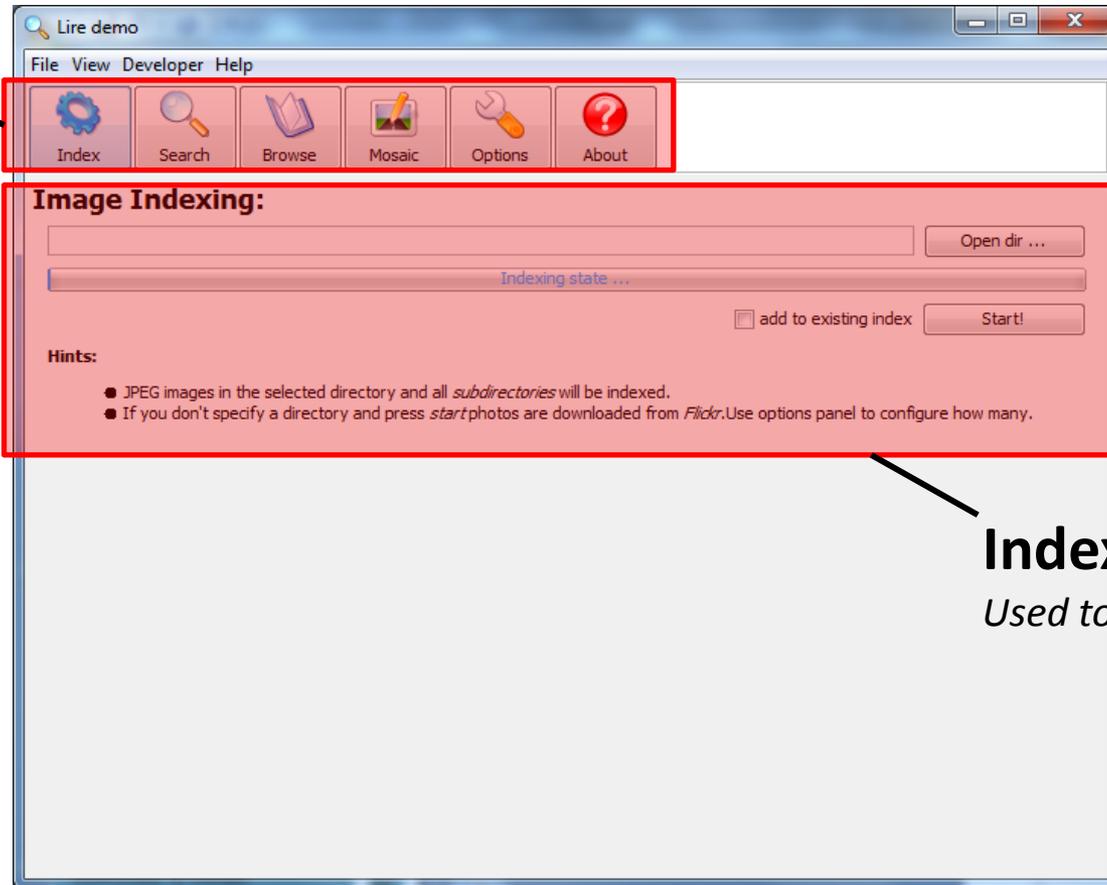


# LireDemo explained



## Main Tasks

Used to switch between panels



## Indexing Panel

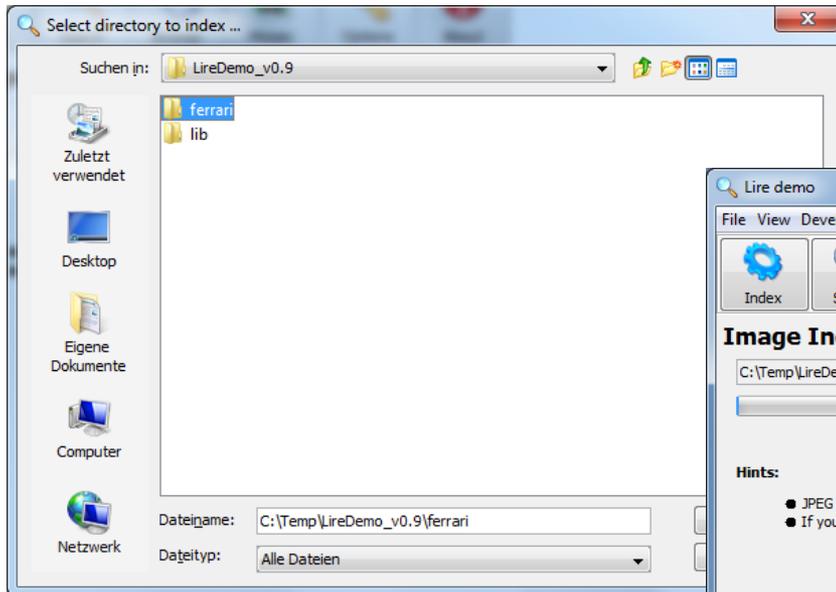
Used to index a set of Photos

# 1<sup>st</sup> Task: Index Photos

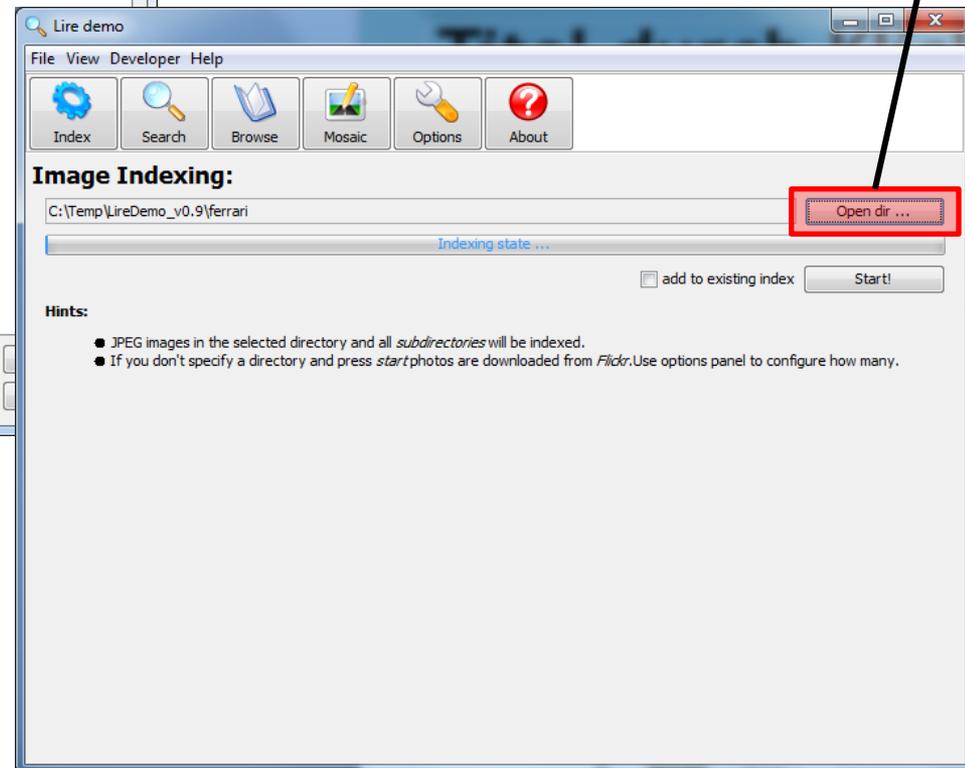


- Download the test data set from the course web page.
  - <http://www.itec.uni-klu.ac.at/~mlux/wiki/doku.php?id=courses:mmisss12>
- Unzip the test data set to a directory of your choice.
- Use the “Open dir ...” button of LireDemo to navigate to the unzipped photos.
  - Select the upper level directory “ferrari”

# 1<sup>st</sup> Task: Index Photos



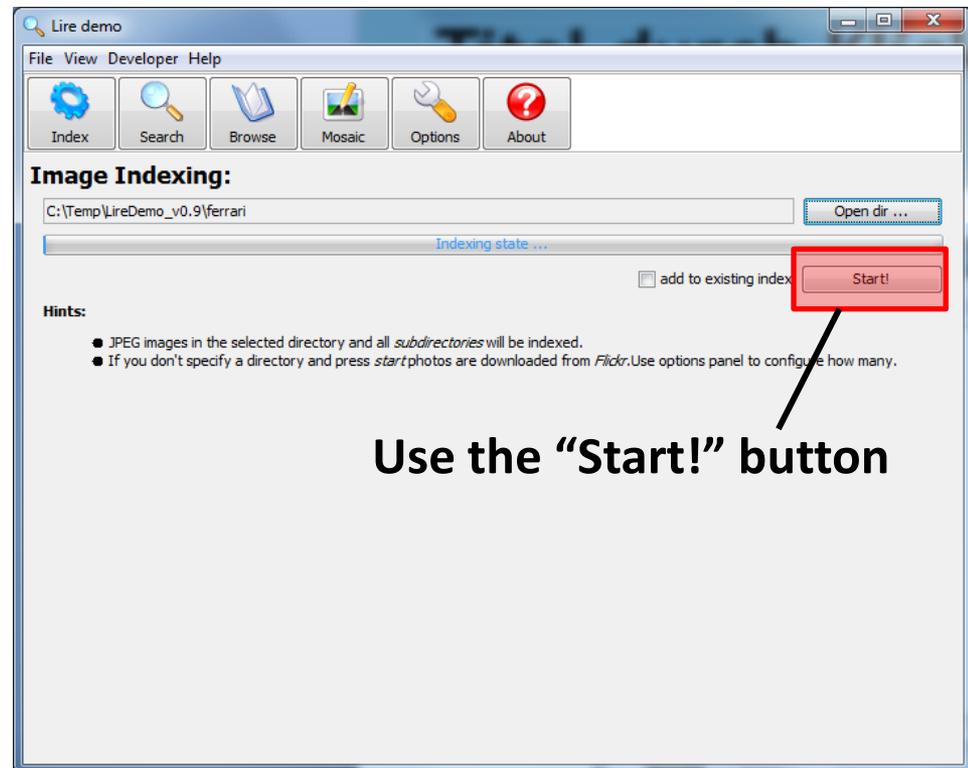
Use the “Open dir ...” button



# 1<sup>st</sup> Task: Index Photos



- Use the “Start!” button to start the indexing process.
- Wait until the progress bar says “Finished”
- This may take up to several minutes, depending on the computer you are using.



Use the “Start!” button

# 2<sup>nd</sup> Task: Browse the Index

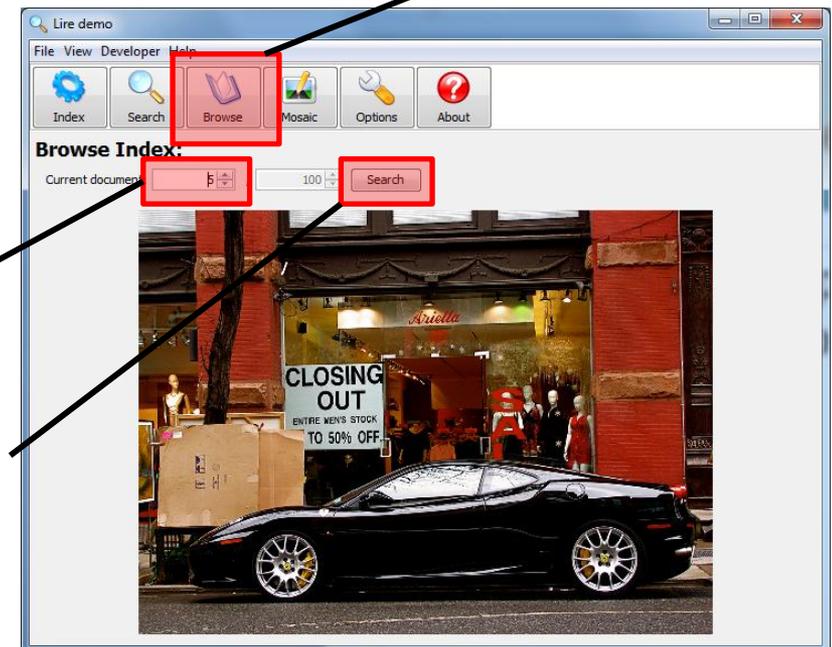


1. Open the browse panel
2. Scan through the indexed photos
3. Trigger a search process

1. Open the “Browse” pane

2. Use the spinner to scan through the photos

3. Trigger a search process



# 3<sup>rd</sup> Task: Scan the Results

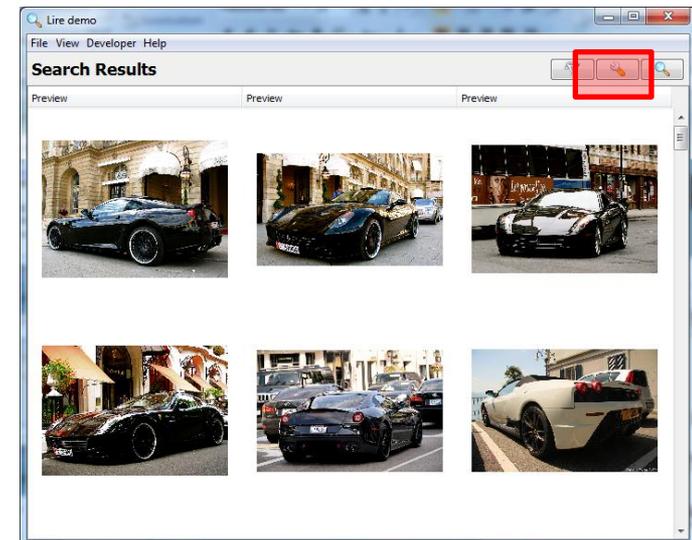


- Investigate the results using the scroll bar.
  - Right click on an image opens your systems image viewer
- Double click on a search result triggers another search with the clicked image as query image.

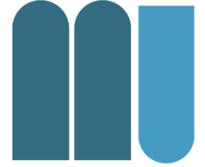
# 4<sup>th</sup> Task: Try other image features



- Click the options button to go to the “Options” panel
- Select another type of “IndexSearcher” there
- Go back to the “Browse” panel and start another search on the same image as before
- Revisit the results for different IndexSearchers and compare the results.



# Readings



C.J. van Rijsbergen: *Information Retrieval - Introduction*,  
London, Butterworth, 1979

*Available on homepage: mmis08 / multimedia*

## Your task:

- Read + answer questions
- Send me an **email** with the answers until next course.

## Questions:

- What is the difference between Data Retrieval and Information Retrieval?
- What does “relevance” mean in the context of Information Retrieval?

# Your Tasks ...



- Get started with Lire
- Read the Introduction to Rijsbergen's book

# Thanks ...



## ... for your attention!