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ECHO - A video digital library

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7-9 June, 2001, IITE, Moscow

Project Figures

- Starting date: February 1, 2000
- Duration: 30 months
- Total effort: 475.8 p/m



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The Partners

Project coordination

IEI-CNR (I)

Content providers

Istituto Luce (I)

Institut National de l'Audiovisuel (F)

Stichting Nederlands Audiovisueel Archief (NL)

Memoriav (CH)



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The Partners (cont.)

Industrial partners

Tecmath (D)

Media Site (UK)

Eurospider Information Technology (CH)

Research institutions

IEI-CNR (I)

Istituto Trentino di Cultura (I)

Centre National de la Recherche Scientifique (F)

University of Mannheim (D)

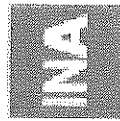
Carnegie Mellon University (USA)



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Project motivations

Large collections of historical documentary films owned by private and public institutions
 Four main national video archives are participating to the ECHO project



ISTITUTO LUCE



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Project motivations

- Increasing interest in using this material in different contexts
 - Professional,
 - Educational,
 - Research



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Main goal

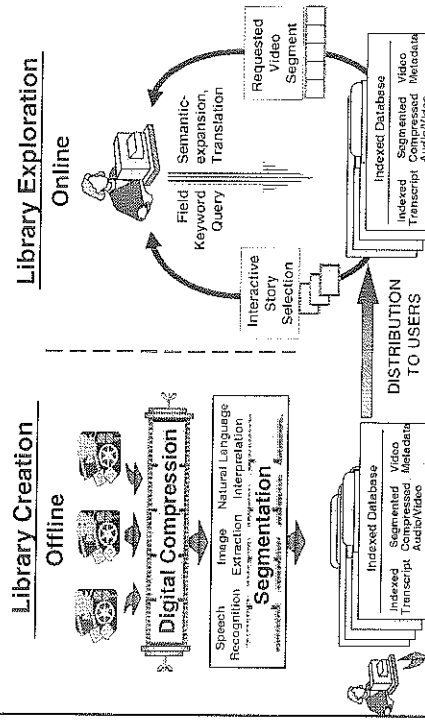
Make possible to access and search by content over the net, large and inter-operating audio visual archives containing historical documentaries.



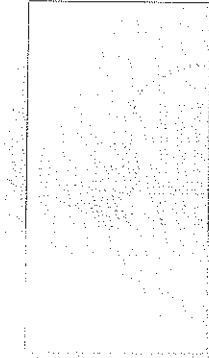
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System Functionality Overview



System Functionality Overview



Key project issues

- User Needs Assessment
- Metadata model for Audio Video documentaries
- Long term reusable software infrastructure for audio visual digital libraries
- Web-based access to large collections in multiple languages
- Automatic speech recognition of old documentary material
- Automatic creation of video summaries
- Experimental test-bed



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User needs assessment

60 users subdivided in different categories

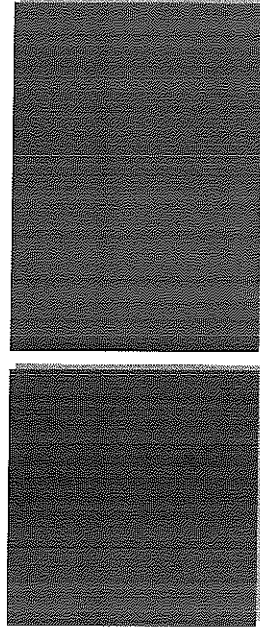
- Educational Environment**
 - Teachers (film/television/new media)
 - Students (history, film)
 - Scientific researchers
- Film & Entertainment Industry**
 - Documentary makers
 - News editors/journalists
 - Librarians/documentalists
- Cultural Heritage Institutions**
 - Keepers/custodians
 - Educational department
 - Exhibitions
- Audiovisual Industry**
 - Product developers
 - Application designers
 - Researchers
- AV Archives**
 - Archivists
 - Sales managers
 - Researchers



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Over 250 questions divided into 8 categories,
linked to several functionalities



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1. Data entry management
Manually added metadata as well as (semi) automatic metadata extraction from digital film information are required.

2. Interface & related databases
Full Web-based interface; the possibility to search in multiple archives of one or more countries in different languages.

3. Cross linguality
Support for full text retrieval as well as document keywords


4. Presentation results
ECHO will provide several presentations, either at the document level or at the level of the search result.

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5. Visual Abstract
The required automatically created (moving) visual summary should capture content and structure of the underlying documentary film for intuitive understanding and give a good overview of the entire content.


6. Browse Copy
The ECHO content should be made available via computer networks and the Internet. The original historical films will be converted into browse copies.

7. Storyboard
In order to get a quick overview of the visual content of a retrieved programme and to be able to start the browse copy at any given point, a storyboard should be generated of each item in ECHO.

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Metadata model and editor

□ Extends the IFLA model

- The IFLA model uses four entities to describe different aspect of a resource:

- WORK
- EXPRESSION
- MANIFESTATION
- ITEM

- Describes a distinct intellectual or artistic creation
- It is the abstract idea of a creation

- We do not specify if we realize a book, a film, or a cartoon

This is described by the Expression Entity.



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Intellectual or artistic realisation of a work in the form of alphanumeric, musical, or choreographic notation, sound, image, etc.

No information on the physical embodiment is given

- Physical embodiment of an expression
- E.g. manuscripts, books, maps, sound, CD, ROM



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A single exemplar of a manifestation



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Metadata model and editor

□ Extends the IFLA model

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□ Hierarchical and Multi-level design

□ Provides support for:

- interoperability
 - by using specialisation/generalisation
 - needs of special interest user communities
 - by using multiple view descriptions



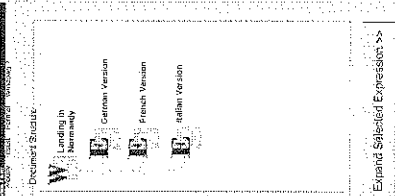
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Metadata editor

The editor allows one to browse in the structure of the WORK

Here, it shows the EXPRESSIONS that compose a WORK



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Metadata editor

We can list all MANIFESTATIONS of each EXPRESSION



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Metadata editor

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Expand Selected Expression >>

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Similarly, we can list all ITEMS of each MANIFESTATION

Metadata editor

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Collapsé Expression <<

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Given an EXPRESSION we can expand it and browse in its the SUB-EXPRESSIONS

Metadata editor

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Expand Selected Expression >>

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Given an EXPRESSION we can expand it and browse in its the SUB-EXPRESSIONS at different levels of detail

Metadata editor

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Collapsé Expression <<

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Given an EXPRESSION we can expand it and browse in its the SUB-EXPRESSIONS at different levels of detail

Metadata editor

At any time we can modify the attributes of each element. Here, we are modifying the WORK attributes

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Metadata editor

Here, we are modifying the EXPRESSION attributes

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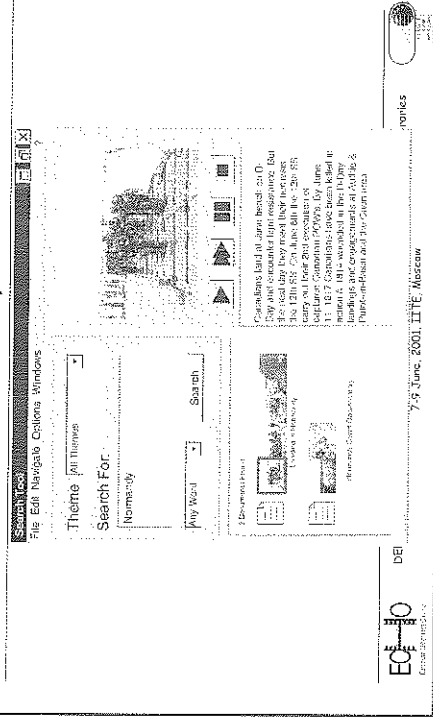
Content Processing

- Combination of speech recognition, image processing, video processing
- Extracts rich content derived metadata
- Manual association of complex metadata to describe A/V content

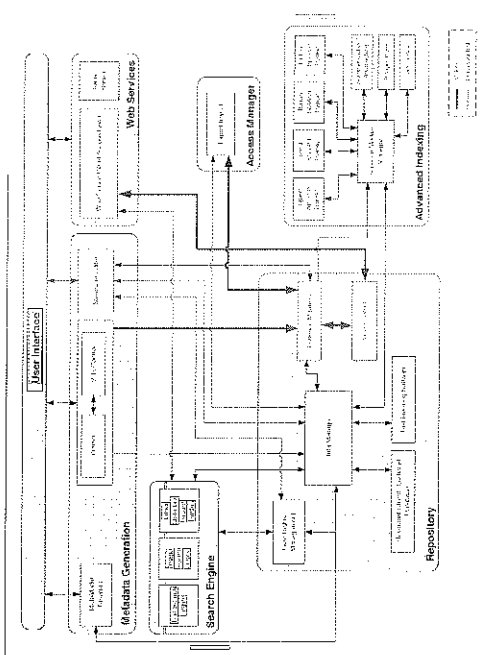
Retrieval functionality

- Free text to search in the transcript of the soundtrack
- Sample images for similarity searching on the film frames
- Keywords to search in the metadata
- Support of cross language retrieval

Retrieval functionality



Modules in ECHO Architecture



A/V DL Software infrastructure

- Strategy
 - Built upon existing research and commercial capabilities in video archive technology & media asset management
 - Carnegie Mellon Univ's Informedia Digital Video Library
 - Tecmath's Media Archive
 - MediaSite's Publisher Suite and Web Finder
 - Advanced indexing processes and modules from other partners (e.g., speech recognition, summarization)
 - Strict distributed client-server model to facilitate
 - Interaction of components from each system
 - Autonomous and asynchronous processing of functions

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Automatic speech recognition

- Three languages (Italian, French, Dutch) plus English
- Problems related to audio quality and with particular language styles.
 - Specific audio data used for training the acoustic and language models of the speech recognizers
- Initial experimental results indicate a Word Error Rate varying from 30% to 60%, depending on the quality of the material



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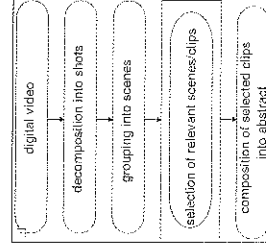


Automatic creation of video summaries

- What is a Video Summary?

A **Video Summary** is a short video characterizing the content of a long video in such a way that the target group is rapidly provided with comprehensive information while the essential message of the long video is preserved.

- Architecture of ECHO Abstracting



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Seven rules to create video summaries

- (1) Important persons and objects shall appear in the abstract.
- (2) Action scenes shall have priority over slowly moving scenes.
- (3) The dominating ambience of the video shall be carried over.
- (4) Dialogs shall be identified and included with high priority.
- (5) Title text and credits shall be included in the abstract.
- (6) No material from original shots shorter than 3 s shall be included in the abstract.
- (7) User preferences and ECHO meta-data shall be used to tailor the abstract.



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Management of special events

The abstracting software toolkit, based on the MoCA workbench developed at the University of Mannheim, contains a set of algorithms to detect special events (explosions, shots, dialogs, etc.). Those can be included into the abstract based on user preferences.



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ECHO Test-bed

- Composed of 200 hours of video documentaries
 - From the four collections, 50 hours per archive
 - Interesting for the user communities
 - 'National' footage 'European' angle
 - Interrelated themes
 - Timespan 1920-present (Focus on 1920-1960 period)
 - Structure: thematically/chronological.
 - Selected documents belonging to 5 themes, each one subdivided into subthemes



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The 5 Main Themes

- 1 Post-War
- 2 The World Wars
- 3 Sports in the 20th Century
- 4 Daily life
- 5 (Youth) Culture in Europe



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Project Milestones

- Sept. 2000
 - Collection and analysis of user requirements
 - Collection analysis and selection
 - Film metadata model definition
 - System Functionality and Global Architecture
- June 2001 - First System Prototype
 - Automatic indexing of documentary films
 - Adaptation and integration of four speech recognition engines for mono-lingual content-based indexing and retrieval.



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Project Milestones (cont.)

- October 2001 - Second System Prototype
 - Metadata editor
 - Indexing of the complete ECHO collection
 - Retrieval based on audio transcripts and metadata
 - Interoperability of digital film collection.
 - Cross-language retrieval.
- March 2002 - Final System Prototype
 - Video summarization
 - Automatic metadata extraction
 - Face detection and recognition
 - Object detection and recognition
 - Key frames feature extraction
 - Access control



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More information on the ECHO Web site:
<http://pc-erato2.iei.pi.cnr.it/echo/>



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