Indexing and Retrieval of Content for Cultural Heritage, Anthropometry and Proteomics

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Virtual Collections

- Museums, archives, libraries and foundations have large collections of images e.g. pictures, paintings, …
- Some have 3D object databases as well
- For the non-specialist, it is very difficult to navigate through these collections: correlations, information linking, association
- And very often for specialists as well!!
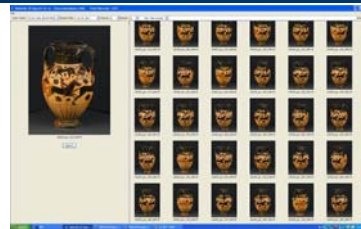- Solution: content-based indexing and management

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EROS Database

- Not Ramazzoti!!!
- C2RMF: Centre de recherche et de restauration des musées de France
- Located at the Louvre Museum
- All museum of France including the Louvre Museum, Orsay, …
- Multispectral, X-rays, UV, IR, emission, … images
- Laboratory analysis
- Historical and scientific notices
- Restoration, monitoring
- ~162.000 images

Venus (-52/260), Chatillon-sur-Seine Museum: Same Site and Material

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Chalcidian Amphora (620/480), Louvre Museum: Different Azimuthal Views

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Portrait of an Old Man with a Young Boy, Domenico Ghirlandaio (1449-1494), Louvre Museum

Multispectral Retrieval; Before and After Restoration

Sitter Seen from the Front, George-Pierre Seurat (1859-1891), Louvre Museum
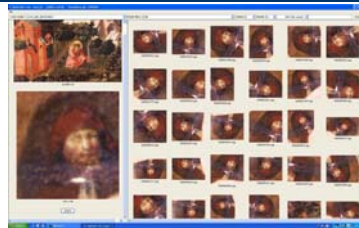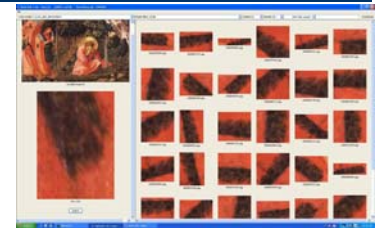

Serat and "Pointillisme"

Conversion of St Augustine, Angelico Fra Giovanni da Fiesole (1387-1455), Thomas Henry Museum

Search Within an Image: in Development: 200.000 Fragments

Search within a Distorted Image: in Development: 200.000 Fragments

The Assisi Basilica: Giotto
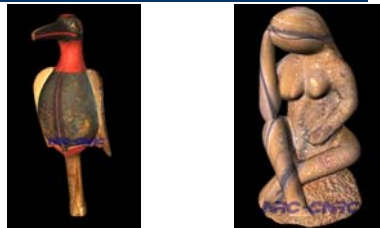

Retrieval of Fragments: 1994 Earthquake…

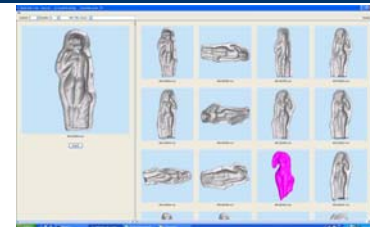**The Assisi Basilica: Cimabue**

Retrieval of Fragments: 1994 Earthquake…

Content-based Indexing and Retrieval of 3D Artifacts

EROS: Anadyomene Venus, 40-300, Anne de Beaujeu Museum: Similar Moulds

Conclusions: Cultural Heritage

- A content-based indexing and retrieval infrastructure is easy to implement and deploy
- Can be integrated to existing database
- Powerful tool for searching and retrieval both for images and 3D artifacts

Human Shape Navigation and Searching

- CAESAR™ Database; USA, Canada, Netherlands, Italy
- 3D indexing
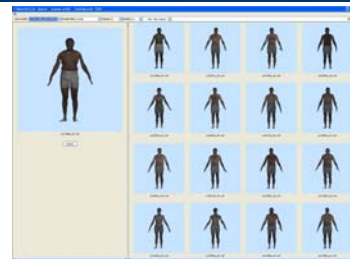- Clustering
- Archetypes
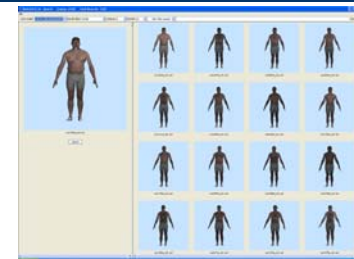- Navigation
- Constraints

Random Search…

Visual Inspection, Selection…

More iterations…

Final Results after 5 Iteration

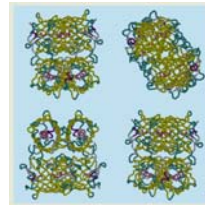## Thin: Final Iteration

Heavy: Final Iteration

Applications

- Anthropometry: 2 SAE Recognition Awards
- Ergonomics
- Virtual Mannequin Calibration
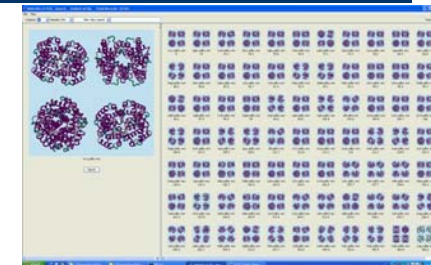- Virtual Human Calibration
- Tailoring: PKDD Awards

Proteomics

- Function of the protein is associate to its 3D shape
- Classification: families are classified by 3D shape
- Mutation
- Drugs design
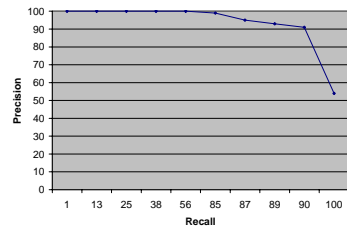- 26.000 proteins from the PDB – Protein Data Bank

Red Fluorescent Protein of the Coral Species (precision: 100%, recall: 100%)
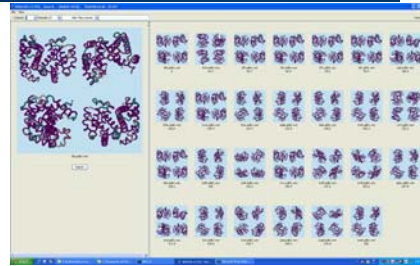

Retrieval of the first 70 similar members of the Homo Sapiens Hemoglobin family within 77 protein structures, using the Irly structure as query, with precision 93% of and recall 89%.
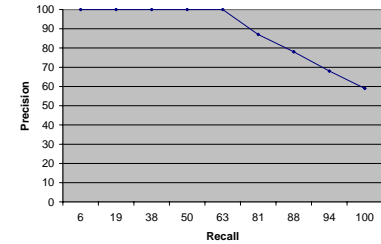
Precision-recall curve (in percentage) for the Homo Sapiens Hemoglobin family, for the 1rly structure as query

Retrieval of all 16 members of the Homo Sapiens Hemoglobin family within 27 protein structures, using the 1flg structure as query, with precision 59% and recall 100%

Precision-recall curve (in percentage) for the Homo Sapiens Hemoglobin family, for the 1lfg structure as query

Conclusions: Proteomics

- Very similar results for other proteins
- Intuitive, fast and easy to use
- Outliers are related e.g. other types of hemoglobin
- Typically, for a given family, a recall of ~100 % is obtained with a precision of ~50 %

Conclusions

- Toward an integrated solution for content-based indexing and retrieval
- Powerful tools for real-life applications
- Thank you!!!
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