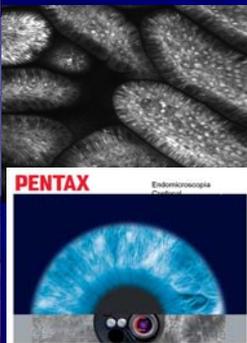


OPTICAL BIOPSY WITH CONFOCAL ENDOSCOPY DIAGNOSED BY PATHOLOGIST



- Prof. Dr. O. Ferrer-Roca et al. 2009 at the 22nd European Congress of Pathology. Florence. Italy
- Coauthors: V. Duval, J. Delgado, C. Rolim, and R. Tous.

The situation OB-CEM



- One of the main problems for endoscopists to use confocal endomicroscopy (CEM) are the optical biopsy (OB) images. **Morphological images** that belong to the domain of pathology-training and are far from endoscopy-training.

Endomicroscopy (CEM)

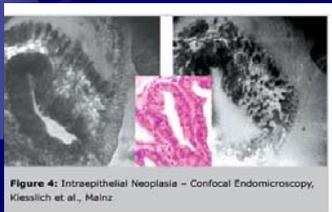
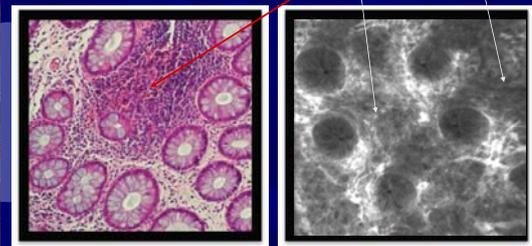


Figure 4: Intraepithelial Neoplasia – Confocal Endomicroscopy, Kiesslich et al., Mainz

- Endomicroscopy is born—do we still need the pathologist?**
Gastrointestinal Endoscopy, Volume 66, Issue 1, July 2007, Pages 150-153
Ralf Kiesslich et al.

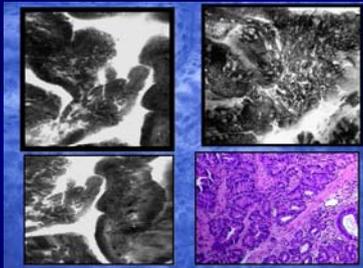
OB-Pathology help



- For that reason the on line pathology diagnosis (**telepathology**) is of paramount importance.
- Alternatively → an **image data mining** to extract the most-likely diagnosis to help endoscopists

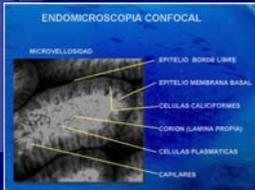
Image data mining

Query by example



- We have developed the metadata structure and the ontology capable to be use by the query multimedia standard ISO/IEC 15938-12 y ISO/IEC 24800-3 to find the possible image and diagnosis using the technique of the “query by example”.

Standardization to annotate, search and retrieve digital images



- MPEG Query Format (MPQF)** and the JPEG's **JPSearch project**
MPQF has already reached its last standardization level, the JPSearch (whose Part 3, named JPSearch Query Format or simply JPQF, is just a profile of MPQF) is still an ongoing work.
- The challenge is to provide an interoperable architecture for images' metadata management

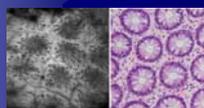
Metadata structure & ontology

Table 2.2. Modified Kuhl criteria for the classification of colorectal cysts architecture in vivo using high-magnification chromoendoscopic colonoscopy

Fig. type	Characteristics	Approximate colony morphology (chromoendoscopy)	Fig. size (mm)
I	Normal round pits		0.57 ± 0.02 mm
II	Stellate or papillary		0.28 ± 0.02 mm
III	Subular (round pits smaller than pit type I)		0.03 ± 0.01 mm
IV	Subular (large)		0.23 ± 0.08 mm
V	Subular / spines		0.93 ± 0.32 mm
VI	Irregular arrangement and size of pits, No. 10 type pit		N/A

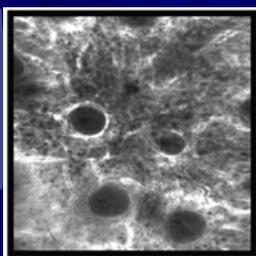
- MPQF expresses queries combining IR & DR
- **IR- Information Retrieval** systems (e.g. *query-by-example* and *query-by-keywords*)
- **DR** the expressive style of **XML Data Retrieval systems** (e.g. XQuery), embracing a broad range of ways of expressing user information needs

IR-like criteria, MPQF



- MPQF include but not limited to *QueryByDescription* (query by example metadata description), *QueryByFreeText*, *QueryByMedia* (query by example media), *QueryByROI* (query by example region of interest), *QueryByFeatureRange*, *QueryBySpatialRelationships*, *QueryByTemporalRelationships* and *QueryByRelevanceFeedback*.

DR-like criteria, MPQF



- MPQF offers its own XML query algebra for expressing conditions over the multimedia related XML metadata (e.g. Dublin Core, MPEG-7 or any other XML-based metadata format) but also offers the possibility to embed XQuery expressions

Web 2.0 images search



- **GOOGLE SIMILAR IMAGES**
<http://similar-images.googlelabs.com/>
- **GAZOPA- Hitachi**
<http://www.gazopa.com/>
- **Lire - Lucene Image Retrieval**
Is a CBIR based on MPEG-7 metadata: ScalableColor, ColorLayout EdgeHistogram
<http://www.semanticmetadata.net/lire/>
<http://lucene.apache.org>
- **Pixolu, semantica image search**
<http://www.pixolu.de/>

CBIR= Content based image retrieval

MATERIAL & METHODS



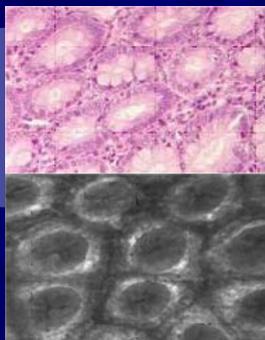
- 25 OB-CEM images
- obtained with a FICE™ (Fujinon Intelligent Chromoendoscopy) &
- Pentax-CEM together with the resulting
- histological images were used in the training set.
- All were JPEG images annotated using standardized metadata for JPSearch ISO/IEC 24800

CBIR- QueryByDescription



- *Content based image retrieval (CBIR)* technique.
- Using *QueryByDescription* type to communicate to the server the specific metadata related to the example image fixed by the requester (e.g. pit size, distance and regularity of normal round pits, detection of stellate or papillary images, so on and so forth). These metadata were extracted whenever possible (by image analysis extraction) before submitting the query to the generic MPQF query processor.

CBIR-SpatialQuery



- *SpatialQuery* type allows requests in the spatial domain where one or two regions (e.g., MPEG-7 StillRegion, etc.).
- Relationships can be expressed by different relation types such as *northOf*, *southOf*, *westOf*, *eastOf*, *contains*, *covers*, *overlaps*, *disjoint*,...
- No CBIR query processors offer this kind of functionality; being the present one an exception

GOLD STANDARD OB-CEM

In surgical pathology six are the main techniques:

- (1) Experience better than evidence;
- (2) Literature knowledge;
- (3) Scientific relevance or eminence
- (4) Interpretation
- (6) Personal impression.

Therefore as soon as we collect sufficient experience with images available and accessed by pathologist, sooner the OB gold-standard will be settled and incorporated into routine diagnostic procedures.

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