Hosting and Managing Large Sets of Virtual Microscopy Slides on the Internet for E-Learning and for Reference

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Some uses for digital slide repositories

- E-Learning
- Reference-Sites
  - digital pathology atlas
  - histology reference sites
  - many other possibilities
- Specialized repositories, e.g. collection of seminars
Problem

- Today’s high volume scanners produce high volume of slide data
- No seamless interface between scanner manufacturer slide repositories and
  - slide presentation systems such as SlidePath
  - E-Learning Systems
  - CMS (Wordpress, Textpattern, others)
- Creating a website with virtual slides is tedious handcrafting, and requires the creation of a specialized interface for the insertion and administration of virtual slides

E-Learning Platform: Moodle 1.9

- Moodle is an open source e-learning system
- It is course-based
- It uses a LAMP (Linux, Apache, MySQL, PHP) architecture
- Most widely used e-Learning system
Advantages of using an E-Learning Environment

- Unified environment for all classes
- User authentication
- Programming capability
- Data repositories
- Exams and questionnaires
- Feedback modules

{ Classroom teaching
  - Self study
  - Examination

Internet  DMZ  Hospital

Sync

Slides  Slides

Home PC  Classroom

E-Learning
Requirements for digital Pathology in E-Learning Systems

- Transparent browsing from within and outside of the hospital firewall
- Switch to connect with internal or external slide repository
- Synchronization between slide repositories
Presentation of digital slides in Moodle

- Moodle is a versatile platform that can be adjusted easily to be used as a platform for digital pathology
- Provides a management interface for embedding digital slides into the E-Learning system
- Consistent layout, easy maintainability,

Load Balancing

Classroom

70 Client PC’s

> 1000 hits / sec

Apache Reverse Proxy

Aperio Image Servers

91
92
93
95
96
Courses

General Pathology Cases (230 slides)

Neuro-Pathology Cases (70 slides)

Dental Pathology Cases (160 slides)

Home Study

General Path.

Neuropath.

Dental Students

Preclinical students

Display of digital slides in the CMS
Preclinical students’ content

Clinical students

- Clinical cases (69)
- Tutorials (33)
- Slide atlas (1363)
- Literature (610)
- Video-Tutorials (28)

- Hematopath.
- Endocrinum
- GI-Tract
- Gyn- and Breast
- Liver, Bile ducts, Pankreas
- Respiratory Tract
- Urogenital Trakt
- Soft Tissue and Bone
Atlas of organ pathology
− User Interface −

GI-Cases

Atlas of organ pathology
− Taxonomy −

1
Gyn-Pathtagry
2
Ovary
3
Tumors
4
Surface-Epithelial Tu.

Fallopian tube
Uterine corpus
Uterine cervix
Vulva and Vagina
Trophoblast

Cysts
Congenital Abnormalities
Inflammatory Disorders
Sexcord-Stromal Tumors
Germ-Cell Tumors
Others (e.g., Steroid-Cell Tu)
Metastases (e.g., Krukenberg-Tu)
Atlas of organ pathology
− Taxonomy −

5 Surface-Epithelial Tu.
   ↓
6 Serous
   ↓
   Endometrioid
   ↓
   Mucinous
   ↓
   Clear Cell
   ↓
   Others
   ↓
7 Borderline
   ↓
   Malignant
   ↓
   Benign
   ↓
8 Cystic
   ↓
   Extraovarian
   ↓
   Special Types (e.g., micropap.)
   ↓
   Peritoneal Implants
   ↓
   Metastases

Atlas of organ pathology
− Categories −

- Complex taxonomical hierarchies, up to 8 levels and more
- Provide horizontal and vertical browsing through hierarchies
- Now > 1300 slides
- Projected: 2500 slides

unlimited categories in Textpattern CMS
Atlas of organ pathology
- Example -

Rosai Collection

official site
rosaicollection.com

- 5635 slides
- 517 seminars
- rich annotations
- all organ systems

→ testing the categorization and embedding into Textpattern
Summary

• Modern E-Learning systems and content management systems can be adapted very well for the management of large series of digital pathology slides.

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UNESCO Guidelines

• ... develop a repository of the work of academic staff ... as a powerful teaching and learning resource

• ... include software applications, such as Web content editing tools, content management systems, templates and toolkits that facilitate the creation and use of adaptable, inclusively designed educational resources

• ... store, manage and share resources and content, both internally and externally, so that academic endeavours build on a growing base of institutional knowledge