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Building a Persistent International Dermatopathological Conference on the Internet

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Keywords

Dermatopathology, virtual , microscope, WWW

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„† ¤ Abstract

The main objective of ¡§Web-based Dermatopathological Conference Server¡is to promote cross national, cross institutional and multi-specialists simultaneous conference. The current status of Dermatopathology slide reading is mostly limited physician himself, at most in small conferences within the hospital, unable to reach cross-nation and cross institute interaction.The project combines ¡§Web-based Dermatopathological Conference Server¡¤ ¡§Multi-purpose Image Storage Server (MISS)¡and ¡§Virtual Conference Server (VCS)¡¤ Technologies, digitalis dermatopathological slides. Allowing more people to participate simultaneously in dermatopathology side image discussion.

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2. Intergrated multimedia annotation system

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Reference

1. http://med.mc.ntu.edu.tw/~somed/ ¡C
2. http://ide.lib.fcu.edu.tw/stat.html ¡C
3. http://www.lotes.ilc.edu.tw/teachteam11.htm ¡C
4. http://www.edu.tw/minister/edu21.htm ¡C
5. http://www.med.harvard.edu/. Harvard Medical School Web.
6. Aston, R., & Schwarz, J. (Eds.)(1994). Multimedia: Gateway to the next millennium. Boston: AP Professional.
7. Buford, J.F.K. (Ed.)(1994). Multimedia systems. Reading, MA: Addison-Wesley.
8. http://www.jccc.net/acad/dl/definition.htm. Johnson County Community College Homepage.
9. http://www.asymetrix.com/solutions/. e-Learning sites homepage.
10. http://www.edweek.org/context/glossary/glossary.htm. Education Week.
11. http://www.uwex.edu/disted/definition.html. Distance Education Clearinghouse homepage .
12. http://bluto.uwex.edu/disted/conference/keynotes.htm. 16th Annual Conference on Distance Teaching & Learning homepage.
13. Gibbs, S.J., & Tsichritzis, D.C. (1995). Multimedia programming: Objects, environments and frameworks. Workingham, England: Addison-Wesley.
14. Jeffcoate, J. (1995). Multimedia in practice: Technology and applications. New York: Prentice Hall.
15. http://www-medlib.med.utah.edu/WebPath/webpath.html. WebPath: The Internet Pathology Laboratory.
16. http://www.pathinfo.com/. The Lightning Hypertext of Disease homepage.
17. http://140.116.5.21/~chungho/patho.htm ¡C Hank's Forensic Page.
18. http://www.kodak.fr/US/en/digital/flashPix/index.shtml. Kodak homepage.
19. http://www.kodak.com/US/en/developers/productsTechnologies/prodTechFlashPix.shtml. FlashPix format, Kodak's Developer Relations Group.
20. http://www.kodak.pt/US/en/digital/flashPix/flashPixHome.shtml. Digital Learning Center, Kodak.
21. http://www.livepicture.com/. LivePicture Co. homepage.
22. http://cpc.tmc.edu.tw/ ¡C
23. http://telpath2.med.utah.edu/. Department of Pathology, University of Utah, Salt Lake City, Utah, USA
24. Internet-based Continuing Medical Education for Chemical Pathology (Pilot Project) gg Dr Ceridwen Dawkins, Department of Chemical Pathology Frenchay Hospital, Frenchay Park Road, Bristol BS16 1LE
25. Barron, Ann, and M. L. Kysilka. "The Effectiveness of Digital Audio in Computer-Based Training." Journal of Research on Computing in Education 25, no. 3 (1993): 277-289.
26. Allen, Rex J. "It's a Circus Out There: The Spectacular ROI of Multimedia-based Training." CBT Solutions (March/April 1997): 1, 8, 10, 12, 14-20.
27. Brett, P. "Using Multimedia: An Investigation of Learners' Attitudes." Computer Assisted Language Learning 9, nos. 2-3 (1996): 191-212.
28. Fernandez, A. et al. "Teaching of the Microbiological Analysis of Water Using a Computer Simulation Program That

Includes Digitalized Color Images." Collegiate Microcomputer 10 (February 1992): 23-32.
29. Kaufman, David, and S. Lee. "Formative Evaluation of a Multimedia CAL Program

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Building a Virtual Clinical Pathology Conference on Internet

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Summary

To hold a clinical pathology conference is very un-convenience in the past, because of preparing lots of microscopes and pathology slides. Besides, though the videoconference is getting more and more popular on the world, it is still not good enough to deliver high-quality image of clinical pathology slides. To solve this problem, we propose a text, audio, video annotation conference server, which is integrated with a virtual microscopic system on Internet. Using this system, the clinicians from all over the world can exchange their professional knowledge more frequently and efficiently.

Keyword:

Pathology, virtual, conference, flashpix, microscope

Introduction and background

To hold a clinical pathology conference, people have to get together in the same time and the same place. Especially people from hospital are usually busy, so the conferences are usually held only within the hospital or department. Another problem is that microscopes are quite necessary in the clinical pathology conference. But it's difficult to prepare many microscope and slides at the time. Without that, people can't observe the clinical pathology slide which is the most important equipment.

Clinically the prevalence of diseases is quite different from places to places. So it's important that let the clinicians can share their experience to each other frequently and efficiently.

With the development of digital technology, it is possible to digitize the clinical pathology slides under 200X magnification microscope. It means that many users can observe many different copies of the same digitized slides from Internet. But, even though, with the steady growth of the Internet bandwidth, the videoconference is still not good enough to deliver high quality images through it.

To solve those problems, a text, audio, and video annotation conference server, which are integrated with virtual microscopic system, are proposed in this article. People can observe images and add annotation on the pathology slide. Using this system, the clinicians can exchange their experience and knowledge frequently and efficiently.

Method

1. Digital image acquisition:

For the pathology purpose, it is important to observe cells for diagnosis. For this purpose, the digital images have to represent the slides under 200x magnification microscope. To reach this task, a 200X magnification image of pathology slide is assembled from lots of images, which are taken from digital camera under 200X magnification microscope.

1.1 Image acquisition from digital camera

We attach a "NIKON 950" digital camera with microscope. The 10X contact lens and 20X object lens are selected. First, set white-balance

manually to keep all images containing of the same color tone. Second, setting shutter speed and aperture manually to keep all image having the same level. Third, shoot the image under the microscope continuously from left-upper corner to right-lower corner. Due to the distortion of optical lens from microscope and digital camera, the overlap area between next two images is better to be bigger. In this case, the overlap area of each image is almost quarter of one image.

1.2 Assemble digital image

After shooting all images, there are approximately more than 100 hundred pieces of images. All pieces of image are loaded into image-retouching software and are assembled manually.

2. Image representation

The finished image is converted into "Flashpix" format that is a multi-resolution digital image file format, which offers an ideal way to view and point high-quality, high-resolution image in real time. Flashpix was jointly developed by Live Picture, Eastman Kodak, Hewlett-Packard, and Microsoft. The format has the specification that can generate multi-resolution image and hotspot. Due to this, we can simulate the effect that can zoom in/out and pan in any direction, like a real light microscope.

3. Image declaration

For research or education, we hope to obtain the particular diseases process, retrospective study information, and the explanation from experienced doctors. The standard approach to this task, for educational and research databases, is to index images manually according to keyword. Right now, the eXtended Markup Language (XML) is popular and flexible in many fields. So we choose XML to descript images. We propose three cores to contain the necessary information.

3.1 Core one: Dublin Core, which is used in digital library field.

To enable the information exchange efficiently, the metadata of the multimedia resource is necessary. In this paper, we adopt Dublin core to design our database structure.

3.2 Core two: Patient profile

To provide the patient information, this part contains patient clinical dataset.

3.3 Core three: Usage management

4. Integrated text, audio, and video annotation conference server

The conference server contains three elements, which are conference scheduling, user profile management, and integrated text, audio, and video annotation.

4.1 Conference scheduling

In this system, different conferences can be held at the same time. There are several kinds of information stored in conference server, for example, Image ID, Modulator ID, and period

4.2 User Profile management

The ID/Password are required to login the system and then the information is reserved until they logout.

4.3 Defining the coordinates

This system enable users observe digitized slide, like using a light microscope. The users can attach the text, audio or video annotation with

anchor to hotspot area. In this coordinating system, “x1, x2, y1, y2” is required parameters, specifying the upper left and lower right coordinates for the hotspot area.

- For example, an image dimensions (500 * 300 pixel)
- Drag out the area for the hotspot, noting the pixel coordinates of the upper left and lower right corner of the area. For example, 106,66 (upper left corner) and 346, 196 (lower right corner)
- Divide the horizontal pixel coordinates by the image width, and the same in vertical pixel coordinates. The result is four relative values for the hotspot.
- Using the four parameters (X1, Y1, X2, Y2), we can represent a hotspot area.

Example:

	Original value	Formula	Relative Values
X1	106	106/500	X1’ 0.2
Y1	66	66//300	Y1’ 0.2
X2	346	346/500	X2’ 0.7
Y2	196	196/300	Y2’ 0.7

Table 1. The result of relative values after transforming from original four parameters is (X1, Y1, X2, Y2).

4.4 Adding anchor and annotation

In the hotspot of image, adding anchor and annotation is possible. We define the anchor’s coordinate as (a, b), and we can transform it into global coordinate (a’, b’) to keep anchor in accuracy position when we zoom in/out or pan. Using the formula to transform anchor’s coordinate (a, b) to global coordinate (a’, b’)

Formula 1. The formula to calculate global coordinate of anchor from relative coordinate

Define anchor’s relative coordinate (a, b), global coordinate (a’, b’)

a’=X1’+ (X2’-X1’) * a / width

b’=Y1’+ (Y2’-Y1’) * b / height

When view of images is changing (new X1’,X2’,Y1’,Y2’ is given), the new coordinate of anchor (a, b) can be calculated by the formula 2.

Formula 2. The formula to calculate new coordinate of anchor in different magnification

Define anchor’s new coordinate (c, d), global coordinate (a’, b’)

c= width * (a’-X1’)/(X2’-X1’)

d= height * (b’-Y1’)/ (Y2’-Y1’)

Result and discussion

To simulate a virtual clinical pathology conference, we integrate image server and conference server. Besides, we assembled 200X magnification pathology slide of skin (which is shown as figure.1). Users not only can observe slides on Internet but also can leave annotation by text, audio or video with anchor on the hotspot of image. We provide a web-based environment to let people exchange information (which is shown as figure 2). Instead of traditional clinical pathology conference, the clinicians can use this system any time and anywhere. But the difficulty of this system is the heavy task of digitizing pathology slide. With experienced technicians, it takes approximate half day to produce one piece of digitized pathology slide. Fortunately, the resolution of

scanner is improved faster and faster. Until right now, there is 4000 dpi slide scanner available.

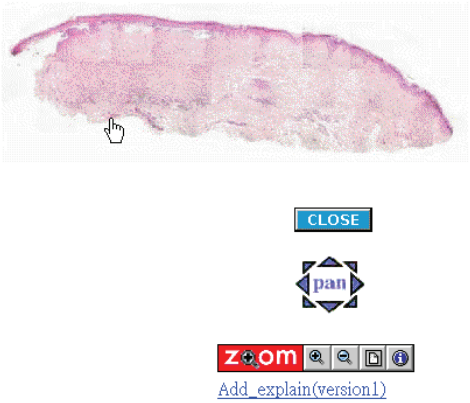

Figure 1. The digitized pathology slide of skin which dimension is approximate 20k* 7k pixels and the file size id 600MB

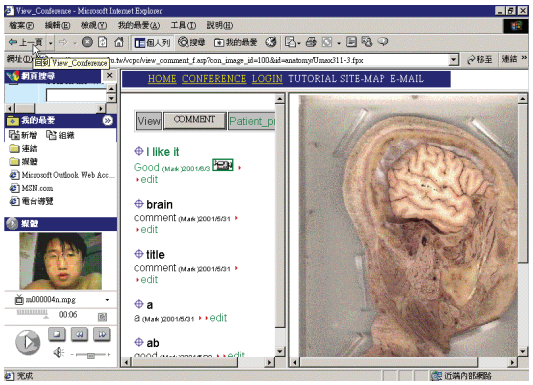

Figure 2. The interface of virtual clinical pathology conference system, which is included text, audio, and video annotation.

Approximate 55X magnification (4000dpi / 72dpi =55 times) we can see on monitor, if we scan the slide directly from slide scanner. If the higher resolution slide scanner is available, the clinical pathology can work like PACS system does right now. In the future, we hope we can build up a multimedia framework to help the medical education more efficiently.

References

30. http://med.mc.ntu.edu.tw/~somed/ ¡ C
31. http://ide.lib.fcu.edu.tw/stat.html ¡ C
32. http://www.lotes.ilc.edu.tw/teachteam11.htm ¡ C
33. http://www.edu.tw/minister/edu21.htm ¡ C
34. http://www.med.harvard.edu/. Harvard Medical School Web.
35. Aston, R., & Schwarz, J. (Eds.)(1994). Multimedia: Gateway to the next millennium. Boston: AP Professional.
36. Buford, J.F.K. (Ed.)(1994). Multimedia systems. Reading, MA: Addison-Wesley.
37. http://www.jccc.net/acad/dl/definition.htm. Johnson County Community College Homepage.
38. http://www.asymetrix.com/solutions/. e-Learning sites homepage.
39. http://www.edweek.org/context/glossary/glossary.htm. Education Week.
40. http://www.uwex.edu/disted/definition.html. Distance Education Clearinghouse homepage .
41. http://bluto.uwex.edu/disted/conference/keynotes.htm. 16th Annual Conference on Distance Teaching & Learning homepage.
42. Gibbs, S.J., & Tsichritzis, D.C. (1995). Multimedia programming: Objects, environments and frameworks. Workingham, England: Addison-Wesley.
43. Jeffcoate, J. (1995). Multimedia in practice: Technology and applications. New York: Prentice Hall.
44. http://www-medlib.med.utah.edu/WebPath/webpath.html. WebPath: The Internet Pathology Laboratory.
45. http://www.pathinfo.com/. The Lightning Hypertext of Disease homepage.
46. http://140.116.5.21/~chungho/patho.htm ¡ C Hank's Forensic Page.
47. http://www.kodak.fr/US/en/digital/flashPix/index.shtml. Kodak homepage.
48. http://www.kodak.com/US/en/developers/productsTechnologies/prodTechFlashPix.shtml. FlashPix format, Kodak's Developer Relations Group.
49. http://www.kodak.pt/US/en/digital/flashPix/flashPixHome.shtml. Digital Learning Center, Kodak.
50. http://www.livepicture.com/. LivePicture Co. homepage.
51. http://cpc.tmc.edu.tw/ ¡ C
52. http://telpath2.med.utah.edu/. Department of Pathology, University of Utah, Salt Lake City, Utah, USA
53. Internet-based Continuing Medical Education for Chemical Pathology (Pilot Project) gg Dr Ceridwen Dawkins, Department of Chemical Pathology Frenchay Hospital, Frenchay Park Road, Bristol BS16 1LE
54. Barron, Ann, and M. L. Kysilka. "The Effectiveness of Digital Audio in

Computer-Based Training." Journal of Research on Computing in Education 25, no. 3 (1993): 277-289.
55. Allen, Rex J. "It's a Circus Out There: The Spectacular ROI of Multimedia-based Training." CBT Solutions (March/April 1997): 1, 8, 10, 12, 14-20.
56. Brett, P. "Using Multimedia: An Investigation of Learners' Attitudes." Computer Assisted Language Learning 9, nos. 2-3 (1996): 191-212.
57. Fernandez, A. et al. "Teaching of the Microbiological Analysis of Water Using a Computer Simulation Program That Includes Digitalized Color Images." Collegiate Microcomputer 10 (February 1992): 23-32.
58. Kaufman, David, and S. Lee. "Formative Evaluation of a Multimedia CAL Program in an Ophthalmology Clerkship." Medical Teacher 15, no. 4 (1993): 327-340.
59. Madsen, M. K., J. A. Grozik, and S. Biro. "An Interactive Media Paradigm for Nursing and Allied Health Professionals." Journal of Medical Education Technologies 4, no. 3 (1994): 19-25.

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