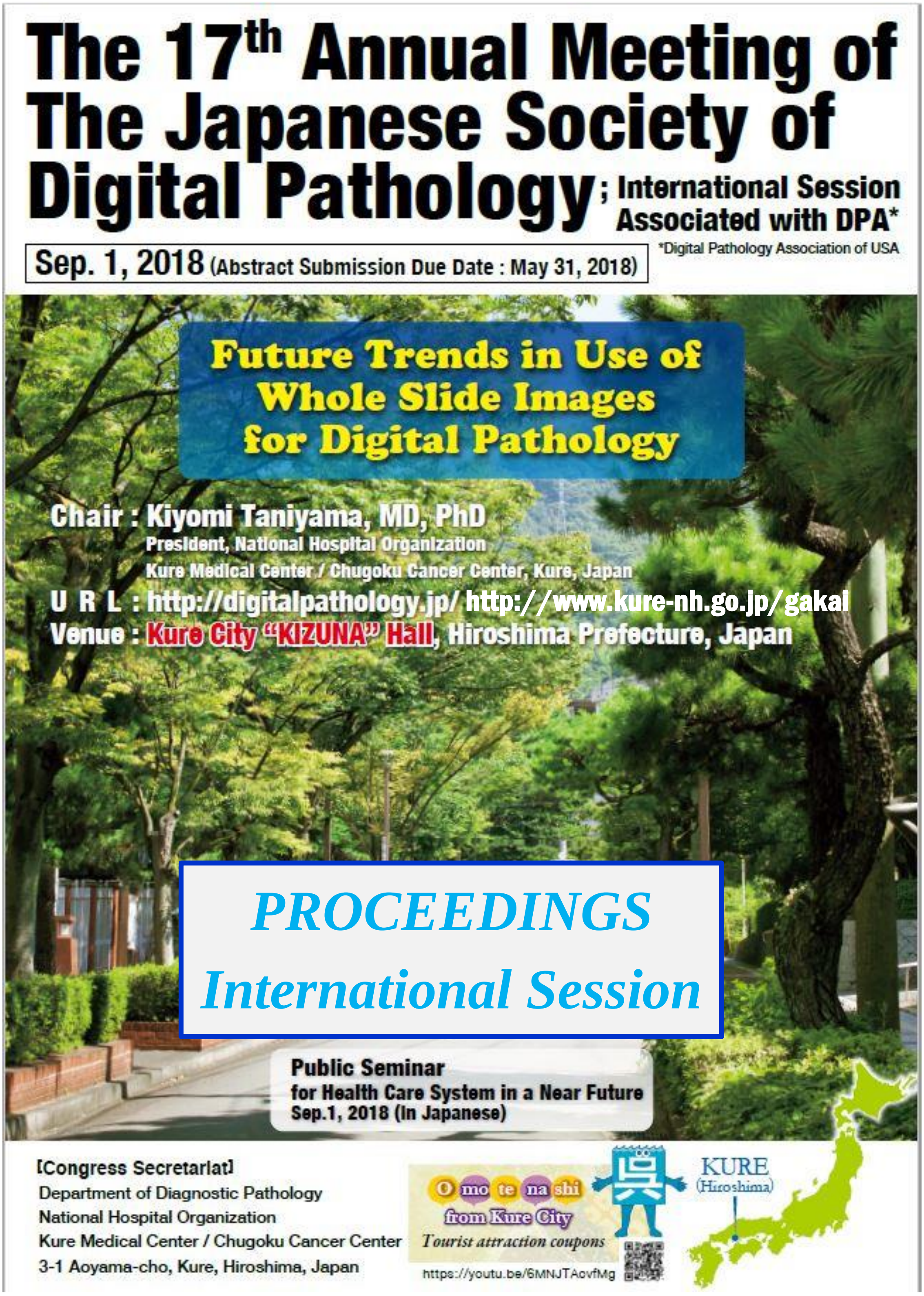
Digi-kun Patho-kun



PROCEEDINGS

International Session

Message from the President

Ichiro Mori, M.D., Ph.D.

President,
the Japanese Society of Digital Pathology.

Professor,
Department of Pathology, International University of Health and Welfare School of Medicine, Narita, Japan.

Digital pathology systems have recently gained considerable popularity in Japan. Since 2017, Japan's health insurance scheme has covered the use of a whole slide image (WSI) system and pathological diagnosis made with WSI outside of the hospital where the pathologist works as a regular staff person. Looking forward, it is clear that a digital future will spread worldwide. Along with such changes, digital pathology systems will bring both benefits and new concerns. With such trends in mind, the 17th Annual Congress of Digital Pathology of Japan will be held in Kure city, Japan. We cordially invite international specialists in digital pathology to participate in this Congress.

We hope to have many participants join us in an engaging discussion about the future of digital pathology.

Message from the Congress President

Kiyomi Taniyama, M.D., Ph.D.
Congress President,
17th Annual Meeting of the Japanese Society of Digital Pathology.

President,
National Hospital Organization of Japan,
Kure Medical Center and Chugoku Cancer Center.

It is my privilege and honor to hold the 17th annual meeting of the Japanese Society of Digital Pathology (JSDP) from August 30th to September 1st of 2018 at "KIZUNA" Hall in Kure City, Hiroshima prefecture of Japan. The international sessions will be held on September 1st.

Digitalizing technology and artificial intelligence (AI) technology have been infiltrating into the field of pathology recently, however, how these technologies will influence pathology diagnostics still remains unclear. To consider such changes, the theme of this Congress is "Future Trends in Use of Whole Slide Images (WSI) for Digital Pathology (DP)."

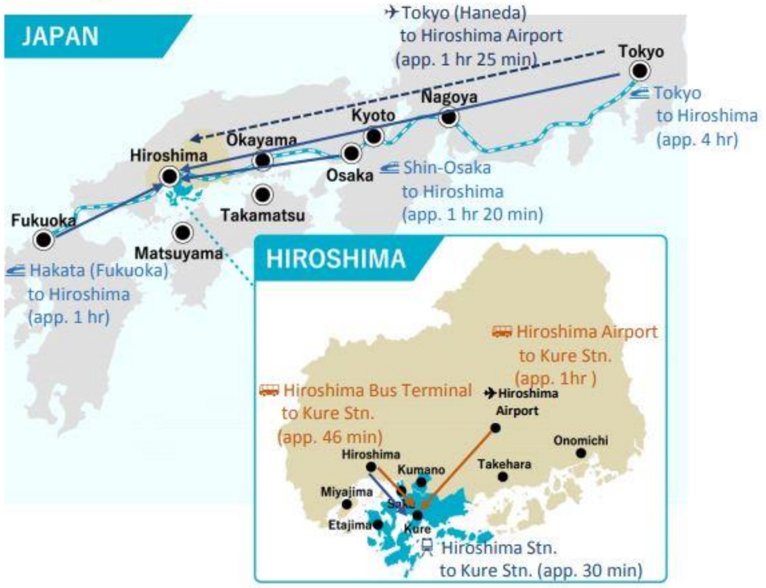
The green traffic signal at the bifurcation beyond the center road in the poster picture suggests going down the right road when we need to choose how to use these new technologies. However, nobody knows the future.

The first and second days of this Congress will have Japanese presentations of practical or trial experiences using DP and AI in Japan. On the third day, an international presentation in English has been programmed. There will also be a workshop about DP in the U.S., a symposium about novel software developments around the world, and discussion on WSI trends between Japan and U.S. pathologists. A public seminar for the Japanese public will also be included in the late afternoon on the third day.

It is my hope that every participant enjoys the Congress and the presentations regarding the latest information in DP and AI. Lastly, the city of Kure welcomes everyone to enjoy the ambiance of the Showa era (latter half of the 20th century) and Japan.

INTERNATIONAL SESSION including Poster Presentation

How to get to Kure



Kure City Central

Transportation from Hiroshima Airport, Hiroshima City Central, Hiroshima JR Station or Kure JR Station;

Hiroshima Airport to Kure JR Station-mae (Terminal at Clayton Bay Hotel) ; Airport Bus
One way; ¥1,340 YEN Two way; ¥2,600 YEN about 60min

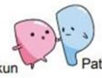
Hiroshima City Central (Bus Center) to Taiikukan-mae bus stop; KUREALINE Bus
One way; ¥710 YEN about 45min

Hiroshima City JR Station to Kure JR Station; Local JR Train
One way; ¥500 YEN about 30 to 40min

Kure JR Station to KIZUNA HALL; Walk 10min or Taxi 3min (¥600 YEN)

Taiikukan-mae bus stop to KIZUNA HALL; Walk 3min

The 17th Annual Meeting
INTERNATIONAL SESSION at KIZUNA HALL
Japanese Society of Digital Pathology



Time Table
September 1st (Saturday), 2018

AM

Chair; K. NAKANE 9:00-9:40am	
W1) Jia QU	9:00-9:10 am
W2) Jun XU	9:10-9:25 am
W3) Najir RAJAPOOT	9:25-9:40 am
Chair; M.M. Bui 9:45-10:30 am	
W4) K. EUREN	9:45-9:55 am
W5) M. NAKATSUGAWA, et al.	9:55-10:05 am
W6) D. TANIYAMA, et al.	10:05-10:15 am
W7) T. TSUKAMOTO, et al.	10:15-10:30 am
Chair; I. MORI 10:35-11:25 am	
W8) A. BYCHKOV, et al.	10:35-10:45 am
W9) Y. YAGI	10:45-11:05 am
W10) Y. TSUCHIHASHI	11:05-11:25 am
<<Special Lecture>>	
Chair; T. SASAKI	11:40 am-0:25 pm
Sp3) A. TOJO	

Company Exhibition 9:00am – 4:00pm
Free Discussion with CITIZEN 3:30 – 4:00pm
<CIVIC MALL>

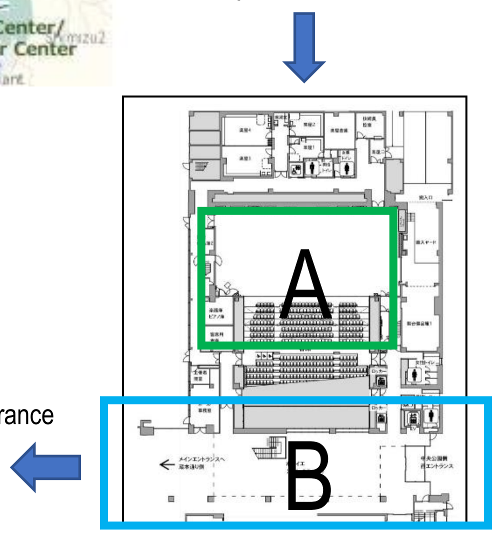
PM

LUNCHEON TIME at SUGIYA Hotel	0:40-1:40 pm
GROUP PHOTO at CIVIC MALL in Kure City Hall	1:45-1:50 pm
<<POSTER SESSION>> at CIVIC MALL	
POSTER Presentation	
Chair; M. WATANABE	2:00-2:30 pm
日本語発表(in Japanese) P1) M. FURUKAWA(古川雅大) et al.	2:00-2:10 pm
日本語発表(in Japanese) P2) N. KOSUGA(小菅則豪) et al.	2:10-2:20 pm
P3) E. DUNGUBAT et al.	2:20-2:30 pm
Chair; CR. LAI	2:30-3:00 pm
P4) WY. LIANG et al.	2:30-2:40 pm
P5) CR. LAI, et al.	2:40-2:50 pm
P6) K. YAMANE	2:50-3:00 pm
<Today's TOPICS>	
Chair; Y. TSUCHIHASHI	3:00-3:30 pm
Lecturer: H. KAMBE	
<<DPA SESSION>>	
Chair; J. FUKUOKA	4:00-6:00 pm
U1) M.M. Bui	4:00-4:40 pm
U2) D.J. HARTMAN	4:40-5:20 pm
U3) A.V. PARWANI	5:20-6:00 pm
<<CLOSING CELEMONY>>	6:00-6:30 pm

Public Seminar at KIZUNA HALL 1:30 – 3:30 pm

Kure City Central

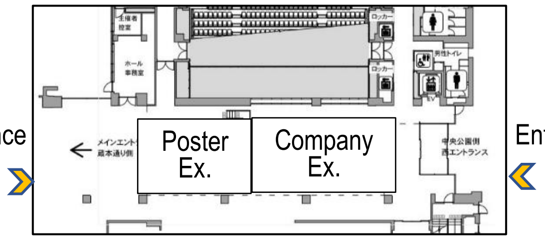
Kure City Hall
(KIZUNA HALL inside)



A; KIZUNA HALL

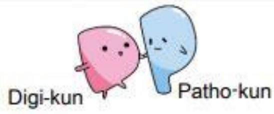
B; CIVIC MALL

Entrance



Entrance

Speaker Instructions



1. The presentation schedule is as conveyed by the secretariat prior to the congress. There will be no timekeeper present. All speakers are asked to keep to the allocated time (individually indicated). The presentation time includes discussion time.
2. Equipment is only available to support computer presentations (i.e., PowerPoint) in the oral sessions. We regret that equipment will not be available for slides or overhead projector (OHP) laminates.
3. Please prepare presentation materials (PowerPoint 2003/2007/2013/2016 ver.) in English.
4. Audio-Visual Materials
   1) Please save your data on one of the following media: CD-R or USB memory stick, and deliver it to the PC Center*. For those wishing to show a movie/video, we recommend that you bring your own personal computer. Please make sure to check in advance that your data has not been infected by any viruses by using the most up-to-date version of your security software.
   2) Please submit your data at the PC Center, and carry out a test and check of whether all the data appears properly. Your data will then be available on standby at the lecture room.
   3) If you need assistance in operation, please do not hesitate to contact staff at the PC Center.
   4) When you are next-in-line to give your presentation, please take a seat at the Next Speaker's Seat.
5. The PC Center will be open during the following hours:

Aug. 30 (Thu)	12:30 - 13:30
Aug. 31 (Fri)	07:30 - 08:30, 12:30 - 13:30
Sep. 1 (Sat)	07:30 - 08:30, 12:30 - 13:30

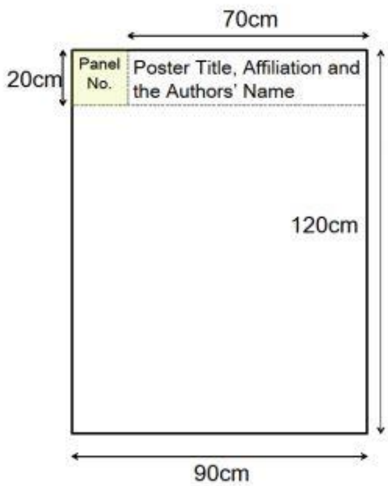
Speakers are requested to provide their materials at least one hour prior to their presentation. For those speaking at a session scheduled in the early morning we kindly ask that you provide your presentation data to the PC Center in the afternoon of the preceding day of your presentation.

*PC Center location: the gallery of the Kure City "KIZUNA" Hall

Poster Session Guidelines

*Some of papers submitted for oral presentation are amended to poster presentation according to the assessment of the organizing committee.

1. The poster design should be in a portrait orientation, no larger than 90 cm wide × 120 cm tall. Use larger fonts that are easier to read. At the upper left of poster, leave a 20 cm × 20 cm space for the Panel Number. The secretariat will provide you with the panel-number label when posters are mounted. An area of 20 cm height × 70 cm in width at the upper part of the panel is to be used to label with your Poster Title, Affiliation, and Authors' Name.
2. Posters can be setup in the gallery of the Kure City "KIZUNA" Hall.
3. Push pins and tape will be available for your use.
4. Any posters remaining on panels after the designated removal time will be discarded by the secretariat.



CONTENTS
INTERNATIONAL SESSION
POSTER SESSION
September 1st, 2018

September 1st, 2018 Saturday

<<INTERNATIONAL SESSION>>

Chair; Kazuaki NAKANE
Osaka University Graduate School of Medicine, Division of Health Sciences, Osaka, Japan

W-1) 9:00-9:10 am (10min)
Cancer detection for pathology images using stepwise fine-tuned deep neural networks
Jia QU, Hirokazu NOSATO, Masahiro MURAKAWA, Kensuke TERAI, Nobuyuki HIRUTA, Hidenori SAKANASHI
Tsukuba University, Japan
National Institute of Advanced Industrial Science and Technology, Toho University Sakura Medical Center, Japan.
Key words; Pathology, Software, Image analysis, Digital, Artificial Intelligence (AI)

W-2) 9:10-9:25 am (15min)
Computational Pathology and its contribution to Precision Medicine
Jun XU Ph.D.
Nanjing University of Information Science and Technology, China (O-11)
Key words; Pathology, Educational, Image analysis, Digital, Whole Slide Image (WSI), AI

W-3) 9:25-9:40 am (15min)
Histology Footprint Analytics
Najir RAJAPOOT, Ph.D.
Warwick University, UK
University Hospitals Coventry & Warwickshire (UHCW), UK
Key words; Pathology, Educational, Image analysis, Digital, WSI, AI
<Break 5min>

Chair; Marylin Bui,
Morsani College of Medicine at the University of South Florida, USA

W-4) 9:45-9:55 am (10min)
Deep Learning with improved annotations
Kristian EURÈN
Contextvision AB, Stockholm, Sweden
Keywords; Pathology, Software, Image analysis, WSI, AI

W-5) 9:55-10:05 (10min)
Deep learning as a tool for cytological and histopathological diagnosis in breast cancer.
Munehide NAKATSUGAWA[1], Oi HARADA[2], Yasuyo OHI[3], Terufumi KUBO[1], Yoshihiko HIROHASHI[1], Takayuki KANASEKI[1], Tomohide TSUKAHARA[1], Toshihiko TORIGOE[1]
[1]Dept. Pathol., Sapporo Med. Univ., Sch. Med., [2]Dept. Pathol., Hokuto Hospital, [3]Dept. Pathol., Hakuaikai Sagara Hospital.
Key words; Cytology, Experimental, Image analysis, WSI, AI

W-6) 10:05-10:15 am (10min)
A new approach to develop computer-aided diagnosis using artificial intelligence for gastric biopsy specimens.
Daiki TANIYAMA[1,2,4], Kiyomi TANIYAMA[3], Kazuya KURAOKA[1,2], Hideki YAMAMOTO[1,2], Junichi ZAITSU[1,2], Akihisa SAITO[1,2], Kenro OSAWA[5], Yoichi YAGUCHI[5], Chika NAKAJIMA[5], Wataru YASUI[4]
[1]Department of Diagnostic Pathology, [2]Institute for Clinical Research, and [3]President, National Hospital Organization Kure Medical Center and Chugoku Cancer Center, Kure, Japan. [4]Department of Molecular pathology, Hiroshima University Graduate School of Biomedical & Health Sciences, Hiroshima, Japan
[5] Olympus Corporation, Tokyo, Japan
Key words; Pathology, Software, Image analysis, Digital, WSI, AI

W-7) 10:15-10:30 am (15min)

Comparison of fine-tuning deep convolutional neural networks for classification of lung cancer types from cytological images.

Tetsuya TSUKAMOTO[1)], Atsushi TERAMOTO[2)], Yuka KIRIYAMA[1,3)], Ayumi YAMADA[2)]
[1)]Department of Diagnostic Pathology, Fujita Health University School of Medicine, [2)]Faculty of Radiological Technology, Fujita Health University School of Health Sciences, and [3)]Department of Diagnostic Pathology, Narita Memorial Hospital, Japan.

Key words; Cytology, Experimental, Image analysis, AI

<Break; 5min>

Chair; Ichiro Mori
International University of Health and Welfare School of Medicine, Narita, Japan

W-8) 10-35-10-45 am (10min)

Nagasaki-Kameda digital pathology network – Establishing a role model for primary diagnosis and multidisciplinary team consultation with effective educational attainment.

Andrey BYCHKOV[1], Kishio KURODA[2], Yukio KASHIMA[3], Yuri TACHIBANA[2], Wataru UEGAMI[1], Youko MASUZAWA[1], Kenshin SUNAGAWA[1], Takashi HORI[1], Yoshinori KOYAMA[1], Aung Myo HLAING[2], Han-Seung YOON[2], Junya FUKUOKA[1,2]
[1] Department of Pathology, Kameda Medical Center, Kamogawa, Chiba Prefecture
[2] Department of Pathology, Nagasaki University Hospital, Nagasaki
[3] Awaji Medical Center, Sumoto, Japan

Keywords; Pathology, Routine practice, Network, Conventional, Digital, WSI

W-9) 10-45-11:05 am (20min)

How to progress the digital pathology in Japan

Yukako YAGI
Memorial Sloan Kettering Cancer Center, NY, USA

Keywords; Pathology, Digital, WSI, AI

W-10) 11:05-11:25 am (20min)

Digital Pathology in Japan, Its Evolution and Future

Yasunari TSUCHIHASHI
Department of Clinical Pathology, Louis Pasteur Centre for Medical Research, Kyoto, Japan

Keywords; Pathology, Digital, WSI, AI

<Break 15min>

Chair; Takeshi SASAKI
Tokyo University, Tokyo, Japan

<< SPECIAL LECTURE>>

11:40-12:25 am (0:25pm) (45min)

AI-guided precision medicine approach to blood cancers

Arinobu TOJO
The Institute of Medical Science, The University of Tokyo, Tokyo, Japan

Keywords; Precision oncology, Blood cancers, Genome, AI

******* Public Seminar at KIZUNA HALL *******

Health Care System in a Near Future (in Japanese) 1:00 – 3:30 pm

Audience: High-school students, their parents and other citizens
Lecturers: T. ITO (Kobe Univ., Hospital, Japan)
S. HARAGAKIUCHI (Kure city officer)
A. UGAJIN (HITACHI, Ltd., Japan)
K. TAMURA (FUJITSU, Ltd., Japan)

(Walk 3min to CITYPLAZA "SUGIYA")

0:40-1:40 pm (60min)

LUNCHEON TIME at SUGIYA Hotel

1:45-1:55 pm (10min)

Group Photo at "CIVIC MALL" in front of KIZUNA HALL

2:00-3:30 pm (90min)

POSTER SESSION

3:30-4:00 pm (30min)

FREE DISCUSSION with CITIZEN

4:00-6:00 pm (120min)

<<DPA SESSION>>

Chair; Junya FUKUOKA
Nagasaki University Hospital, Nagasaki, Japan

U-1)
Current State of Digital Pathology, Digital Pathology Association and Building a Brighter Digital Future Takes a Village
Marilyn M. Bui
Moffitt Cancer Center, USA
Keywords; Pathology, Software, Image analysis, Digital, AI

U-2)
Whole Slide Imaging and Digital Pathology Guidelines in the United States
Douglas J. HARTMAN
Pittsburgh Medical Center University, USA
Keywords; Pathology, Routine practice, Digital, WSI, AI

U-3)
Current state of WSI and Artificial Intelligence for clinical diagnostics
Anil V. PARWANI
Ohio State University Wexner Medical Center, USA
Keywords; Pathology, Digital, WSI, AI

6:00-6:30 pm (30min)

<<CLOSING CELEMONY (閉会式)>>

Message from the next Congress President (第 18 回デジタルパソロジー研究会総会会長挨拶)
Mr. Takashi OGURA, HAMAMATSU Photonix, Co., Ltd., Hamamatsu, Japan

Closing Remarks by JSDP President (デジタルパソロジー研究会会長挨拶)
Prof. Ichiro MORI, International University of Health and Welfare School of Medicine, Narita, Japan

<<ポスター発表/ POSTER SESSION>>
9 月 1 日午後 2 時 - 3 時半/ Sep. 1st, 2:00-3:30 pm (90min)
Chair; 渡辺みか (Mika WATANABE)
東北大学 (Tohoku University)

P1 (日本語発表/ Presentation in Japanese)
BioBank system を用いた遺伝子解析の手法の確立とデジタルパソロジーとの統合
(Establishing the way of extracting DNA with BioBank kit and integration with digital pathology)
古川雅大(医学部学生)、二口充、早田正和、福岡順也
Masahiro FURUKAWA(student), Mitsuru FUTAKUCHI, Masakazu SODA, Junya FUKUOKA
長崎大学大学院病理学講座
(Department of Pathology, Nagasaki University Graduate School of Biomedical Sciences)
長崎病理医育成・診断センター
(Nagasaki Educational and Diagnostic Center of Pathology(NEDCP)
Key words; Pathology, Routine practice, Network, Digital, WSI

P2 (日本語発表/ Presentation in Japanese)
Panoptiq (ViewsIQ)を用いた Whole slide image (WSI)を利用した細胞診検診業務の実際
小菅則豪、青山肇，黒島義克、大竹賢太郎，吉見直己
Key words; Cytology, Routine practice, Network, WSI

P3 (Presentation in English)
Telepathology – Past, Present and Future in Mongolian steppe
Erdenetsogt DUNGUBAT
Department of Pathology & University Hospital, Mongolian National University of Medical Sciences (MNUMS)
Key words; Pathology, Routine practice, Network, Conventional, Digital

Chair; Chiung-Ru LAI
Taipei Veterans General Hospital

P4 (Presentation in English)
Evaluation of Malignant Colorectal Polyps Using Desmin Immunohistochemistry and Virtual Slide Image.
Wen-Yih LIANG, Yen-Yu Lin, Fen-Yau Li
Taipei Veterans General Hospital
Key words; Pathology, Routine practice, Case study, Conventional, Digital, WSI

P5 (Presentation in English)
Application of Online Videos Linking with QR Codes Establishes A Novel E-learning Platform in Cytopathology.
Chiung-Ru LAI, Mau-Ren HUNG, Bao-Rung ZENG, Jen-Fan HANG, Jie-Yang JHUANG
Taipei Veterans General Hospital
Key words; Cytology, Educational, Network, Digital

P6 (Presentation in English)
Analyzing method for the digital colonic tissue images via topological concept
(位相幾何学的手法を用いた大腸組織解析技術について)
Kazuaki NAKANE
Osaka University Graduate School of Medicine, Division of Health Sciences
Key words; Pathology, Software, Image analysis, Digital, WSI

Today's TOPICS

3:00-3:30 pm (30min)
Chair; Yasunari TSUCHIHASHI
Louis Pasteur Centre for Medical Research, Kyoto, Japan

Cytodiagnosis Support System with AI-Scan

Hisashi KAMBE
BRAIN CO., LTD., Hyogo, Japan
Keywords; Company, Software, Image analysis, AI

{{{{{{ MEMO }}}}}}

PROCEEDINGS
INTERNATIONAL SESSION
POSTER SESSION
September 1st, 2018

Today's TOPICS

Cytodiagnosis Support System with AI-Scan

Hisashi KAMBE

CEO, BRAIN CO., LTD., Hyogo, Japan
Keywords; Company, Software, Image analysis, AI

Abstract
Cooperation between cytotechnologist and cytodiagnosis specialist is indispensable. It is expected from various quarters to realize diagnostic support system for cancer cells using artificial intelligence (AI). Recent diagnostic imaging researches often use deep learning. In order to achieve some discrimination by deep learning, tens of thousands of training data are required, and it is difficult to verify the identification process. This research aims to reflect the technique and knowledge of a specialist in AI and to establish a cancer cell identification technology put to practical use with a small number of training data.
We pioneered the AI cash register for bakery called BakeryScan. There is no barcode on unpacked bread. BakeryScan identifies unpackaged bread by image and checks out in a moment. It is the first check-out system in the world with AI. There are over 300 units in operation at bakery in Japan. Generally bread has conflicting appearance characteristics, "similarity between different species" and "individual difference between the same species". We will develop a cancer cell diagnostic support system based on the identification algorithm, AI-Scan, which solved this conflicting problems and succeeded in practical use in bakery.
This system has useful functions to assist for cytotechnologist and cytodiagnosis specialist in diagnosis.
- It performs screening and marks suspicious cells of many slide images.
- It extracts suspicious cell regions, calculates hand-crafted features and makes a diagnosis with AI.
- It shows a diagnostic criteria to specialist.
- It prompts confirmation of the diagnostics result, and it learns from the diagnosis corrected by specialist and recons.
This system will reduce the burden of cytotechnologist and cytodiagnosis specialist.

Curriculum Vitae

1974	Tokyo University of Agriculture and Technology, Tokyo, Japan
1974-1978	Matsushita Electric Works, Ltd.(Panasonic Electric Works Co., Ltd.), Osaka, Japan
1982-	BRAIN CO., LTD., Hyogo, Japan

<<SPECIAL LECTURE (3)>>

AI-guided precision medicine approach to blood cancers

Arinobu TOJO, MD, PhD

Professor,
Division of Molecular Therapy,
The Institute of Medical Science, The University of Tokyo (IMSUT),
Director, IMSUT Hospital, Tokyo, Japan
Keywords; Precision oncology, Blood cancers, Genome, AI

Abstract

Next generation sequencing (NGS) of cancer genome is now becoming prerequisite for accurate diagnosis and proper treatment in clinical oncology (Precision oncology). While the genomic regions for NGS expand from a certain set of genes to whole exome or whole genome, the resulting sequence data becomes incredibly enormous, and then makes it quite laborious to translate the genomic data into medicine, so-called annotation and curation. We organized a clinical sequencing team and established a bidirectional (bed to bench and bench to bed) system to integrate clinical and genomic data in blood cancers. We also started a collaborative research with IBM Japan to adopt artificial or augmented intelligence (AI), Watson for Genomics (WfG), to the pipeline of medical informatics. Genomic DNA was prepared from cancer cells as well as normal tissues (buccal swab) in each patient, and subjected to NGS. Sequence data was analyzed using an in-house semi-automated pipeline in combination with WfG, which was used to identify candidate driver mutations and relevant pathways, from which applicable drug information was deduced. Until now, we have analyzed as many as 200 patients with blood cancers including leukemia and lymphoma, and could obtain many informative findings. In this presentation, I will introduce some of the achievements we have obtained so far.

Curriculum Vitae

1981	M.D., The Faculty of Medicine, Tokyo Medical and Dental University, Tokyo, Japan
1988	Ph.D., The Graduate School of the Faculty of Medicine, the University of Tokyo, Tokyo, Japan
1988 -1991	Assistant Professor, Department of Hematology/Oncology, IMSUT Hospital
1991 – 1995	Assistant Professor, Department of Pathological Pharmacology, IMSUT
1995 – 2002	Lecturer, Department of Hematology/ Oncology, IMSUT Hospital
2002 – 2005	Associate Professor, Division of Molecular Therapy, Advanced Clinical Research Center, IMSUT
2005-	Professor, Division of Molecular Therapy, Advanced Clinical Research Center, IMSUT, Manager, Department of Hematology/ Oncology, IMSUT Hospital
2012-2018	Director, Advanced Clinical Research Center, IMSUT
2018-	Director, IMSUT Hospital

W-1) Cancer detection for pathology images using stepwise fine-tuned deep neural networks

Jia QU, Ph.D. candidate.

Tsukuba University, Japan,

Key words; Pathology, Software, Image analysis, Digital, Artificial Intelligence (AI)

Abstract
Deep learning using Convolutional Neural Networks (CNN) has demonstrated a powerful tool for many image classification tasks. Due to its outstanding robustness and generalization, as well, it is expected to play a key role to facilitate advanced Computer-Aided Diagnosis (CAD) for digital pathology images. However, since a large amount of well-annotated training data are more demanded than conventional approaches ever before, the shortage of high quality annotated digital pathology images has become a major issue at present. Aiming at this problem, progressive training techniques are more and more focused in order to reinforce the capacity of deep neural networks. In our work, looking forward to further boosting the performance of the state-of-the-art deep neural networks and alleviating the insufficiency of well-annotated data, we have proposed a novel stepwise fine-tuning based deep learning scheme for digital pathology image classification, and establishes a new type of target-correlative intermediate data which can be generated with very limited extra cost. By adopting the proposed scheme, deep neural networks are expected to acquire fundamental pathological knowledge in advance and get a more target-correlative optimization than training from scratch. The experiments are implemented on several state-of-the-art deep neural networks. The results congruously demonstrate the feasibility of our proposed scheme for boosting the classification performance and alleviating the insufficiency of well-annotated data.

Curriculum Vitae

2010	Bachelor of engineering, Harbin Institute of Technology, China.
2013	Master of engineering, University of Tsukuba, Japan.

W-2) Computational Pathology and its contribution to Precision Medicine

Jun XU Ph.D.

Professor,
Nanjing University of Information Science and Technology, China

Key words; Pathology, Educational, Image analysis, Digital, Whole Slide Image (WSI), AI

Abstract: Computational pathology is the integration of digital pathology with advanced artificial intelligence (e.g., machine learning) technology. Its goal is to use a combination of primary sources of data (e.g., pathology, radiology, clinical electronic medical records, laboratory data, etc.) to achieve more accurate disease diagnosis and optimal clinical care. My talk comprises the following four aspects: 1) what is the computational pathology and how this technology will change the pathologists' role in clinical care; how computational pathology will contribute to precision medicine. 2) our recent works in developing advanced deep learning based approaches for the histopathological image analysis in the cells and tissues level computation; 3) Based on the cells and tissues level computation, PathOmics were developed towards tumor quantification and precision disease diagnosis and prognosis; 4) Our recent work on the fusion of radiological and pathological data for more accurate diagnosis and prognosis.

Curriculum Vitae

2004	M.S., University of Electronic Science and Technology, Chengdu, China
2007	Ph.D., Zhejiang University, Hangzhou, China
2007-2011	Postdoctoral, Rutgers University, USA
2014, 2018	Visiting Professor, Case Western Reserve University, USA
2011-	Professor, Nanjing University of Information Science and Technology, China

W-3) Histology Footprint Analytics

Najir RAJAPOOT, Ph.D.
Professor in Computational Pathology,
Warwick Univ. UK
University Hospitals Coventry & Warwickshire (UHCW), UK

Key words; Pathology, Educational, Image analysis, Digital, WSI, AI

Abstract
The human brain is fantastic at recognizing people and objects and building an understanding of the natural world around us. However, the visual cortex is not ideal at objectively measuring what we see and complex spatial patterns hidden in plain sight cannot sometimes be deciphered by the naked eye. Computational Pathology is an emerging discipline concerned with the study of computer algorithms for understanding disease from the analysis of digitised histology images. I will show some snippets of computational pathology research in my group to demonstrate the value of analytics of information-rich, high-resolution whole-slide images (WSIs, the so-called Big Cancer Image Data) for cancer diagnosis and prognosis. I will show examples of how histological motifs extracted from digital pathology image data are likely to lead to patient stratilication for precision medicine. I will then discuss some of the main challenges in digital pathology and opportunities for exploring new unchartered territories.

Curriculum Vitae

1996	MSc, Quaid-e-Azam University, Pakistan
2001	PhD, University of Warwick, UK
2001-	Professor, University of Warwick, UK
2016-	Honorary Pathology Scientist, University Hospital Coventry & Warwickshire (UHCW) NHS Trust, UK

W-4) Deep Learning with improved annotations.

Kristian EURÈN
Contextvision AB, Stockholm, Sweden

Keywords; Pathology, Software, Image analysis, WSI, AI

Abstract

Contextvision decided to enter the field of digital pathology 2 years ago with the approach to produce a decision support tools with trained Deep Learning Neural Networks. We realized early that the big challenge was not to make the algorithm but to get consistent data to train and evaluate the network. Inter- and intra- observer variations among pathologist is one problem and this can also be addressed to large variation in sample preparation, staining, scanning quality and local variations in interpretation. A big problem for us is also the variations in drawing between pathologists, making comparisons of algorithm performance very difficult.

In order to produce a robust algorithm, we need huge amount of consistently annotated WSI's so we needed to increase the speed and quality of annotations.

We approach this problem in two ways.

First, we designed an annotation tool with auto-border recognition and a fast brush-tool for annotations. The tool also enables the user to zoom and pan while annotating.

Secondly, we developed a method to use fluorescence multiplexing with subsequent H&E staining to generate pathology images with biomarker support for annotation. With fluorescence we can easily use 4 biomarkers to stain for diagnostic biomarkers, e.g. basal cells and AMACR in prostate cancer, and project these on the H&E image. We can also stain for morphological markers, e.g. pan-cytokeratin, to visualize and mask morphological areas.

In the first phase we will use these images to guide pathologists to annotate and also outline regions of interest so the annotating pathologist don't have to draw in the image.

Next phase will be to automatically select areas for deep learning training based on biomarker and morphological markers.

We also provide validated workstations to our annotating pathologists to ensure consistent quality of annotations.

All these actions will ensure us to get as consistent and objective annotations as possible and allows us to generate a algorithm with high robustness that the pathologists can trust.

The final product will be integrated with the local LIS system and automatically perform prediction of selected tissue samples, e.g. prostate biopsies, after they are scanned. When the pathologist opens the case on his workstation, the slides are already sorted in a "worst first" order. After reviewing the case, the software will automatically create a report for the pathologist to sign.

The software will improve the quality and speed of the diagnosis by;

- Reducing observer variability
- Make the pathologist to concentrate on the difficult samples instead of screening benign glasses
- Never miss a suspicious area regardless of the workload
- Automatically measure and quantify morphological structures
- Generate a structured report

W-5) Deep learning as a tool for cytological and histopathological diagnosis in breast cancer.

Munehide NAKATSUGAWA, et al.
Dept. Pathol., Sapporo Med. Univ., Sch. Med.

Key words; Cytology, Experimental, Image analysis, WSI, AI

Abstract

Diagnosis and treatment in breast cancer have been progressing and getting complex recently. Development of novel diagnostic technology is needed in breast cancer. In liquid based cytology (LBC), preparation of samples is more reproducible and inadequate samples decrease. However, diagnostic technique of LBC can be different from the one of traditional smear samples and the screener needs to have an abundant skill to reach high accuracy of diagnosis. Intraoperative rapid diagnosis of sentinel lymph nodes (SLNs) in breast cancer is essential to determine the extent of resection. However, the pathologist does not always reside in the medical center. Artificial intelligence (AI) generated by deep learning technology is an emerging research area in digital pathology. Deep convolutional neural networks (DCNNs) have proven to be very successful in classifying and detecting objects. In this study, we investigated whether deep learning can be helpful for LBC diagnosis and intraoperative rapid diagnosis of SLNs in breast cancer. In LBC study, DCNNs were trained using whole slide images of LBC samples including malignancy or benign. The trained DCNNs showed high accuracy for diagnosis of malignancy. Because LBC has thin layer of cells, indicating less cell overlapping, it could be suitable for computational image analysis. We have also analyzed thyroid LBC specimens using the same procedure. In rapid metastasis diagnosis of SLNs, we used object detection algorism which allows us to enable real-time detection. It has also been utilized in automated driving technologies at research level. We investigated whether real-time object detection can be helpful for rapid diagnosis of SLNs metastases in breast cancer. We prepared digital images of frozen section of SLNs with bounding boxes indicating cancer tissue for training. In prediction, a display image rendering the HE-stained SLNs slide image was captured continuously and the trained detector could predict cancer area in the captured SLN image in real time. Metastatic SLNs was detected with high accuracy. These results indicate that AI based on deep learning can possibly be helpful for cytological and histopathological diagnosis in breast cancer.

W-6) A new approach to develop computer-aided diagnosis using artificial intelligence for gastric biopsy specimens.

Daiki TANIYAMA, MD, et al.
Department of Molecular pathology, Hiroshima University Graduate School of Biomedical & Health Sciences, Hiroshima, Japan.
Key words; Pathology, Software, Image analysis, Digital, WSI, AI

Abstract
Background
Computer-aided diagnoses of radiological images using artificial intelligence (AI) thru deep learning (DL) algorithms have been reported. Currently, however, such methods are not practically available for histopathological diagnosis. Since 2016, we have been developing software that supports pathological diagnosis through the use of AI. Our aim was to develop software that has 100% sensitivity and more than 50% specificity. At this meeting, we report on this concept and the status of our current software development.
Materials and methods
A convolutional neural network (CNN) was used to detect an adenocarcinoma (ADC) region within a histopathological image. According to the results of the detection, the image is classified into either ADC or non-adenocarcinoma (NADC). Among gastric biopsy specimens referred to the pathology unit at our institute between 2015 and 2018, 192 samples were extracted, except for signet ring cell carcinoma and adenoma. The samples were scanned and digitalized with a VS800 WSI system (Olympus, not for sale) by a 40x objective lens. One sample image consists on the order of one hundred million pixels, and the CNN was trained by learning about each pixel annotated as ADC or NADC. Subsequently, 786 samples (297 samples of ADC and 489 samples of NADC) were classified with various thresholds for the CNN classification and a receiver operating characteristic (ROC) curve was created from the sensitivities and the specificities (Study 1). The threshold that meets the concept requirements in parts (100% sensitivity) was decided from the ROC curve. Subsequently, an additional 140 samples (67 samples of ADC and 73 samples of NADC) were classified with the threshold (Study 2).
Results
In study 1, the threshold was set so as to classify all 297 ADC samples as positive, and 160 out of the 489 NADC samples with the threshold were classified as negative. The sensitivity was 100% (297/297) and the specificity was 32.7% (160/489). In study 2, using the same threshold, all 67 ADC samples were classified as positive and 22 out of the 73 NADC samples as negative. The sensitivity was 100% (67/67) and the specificity was 32.7% (22/73).
Conclusion
Computer-aided diagnosis with a low false negative rate is considered as supportive for pathologists and reduces the time needed to arrive at a diagnosis of non-malignant cases. Since non-malignant cases comprise the majority of gastric biopsy examinations in Japan, this function may reduce the workload on pathologists.

W-7) Comparison of fine-tuning deep convolutional neural networks for classification of lung cancer types from cytological images.

Tetsuya TSUKAMOTO, MD, Ph.D.
Professor, Department of Diagnostic Pathology,
Fujita Health University School of Medicine, Japan.

Key words; Cytology, Experimental, Image analysis, AI

Abstract

Lung cancer is a leading cause of death worldwide. Depending on the recent progress of therapeutics, accurate classification of cancer types (adenocarcinoma, squamous cell carcinoma, and small cell carcinoma) is required. However, improving the accuracy and stability of diagnosis is challenging especially in cytological diagnosis. We have previously developed an automated classification scheme for lung cancers presented in microscopic images using a deep convolutional neural network (DCNN), which is a major deep learning technique. Our original DCNN consists of 3 convolutional, 3 pooling, and 2 fully connected layers. In evaluation experiments conducted, the DCNN was trained using our original database with a graphics processing unit. Microscopic images were first cropped and resampled to 256 × 256 pixels and were augmented via rotation, flipping, and filtering to prevent overfitting. The probabilities of three types of cancer types were estimated using the developed scheme. Classification accuracy was evaluated using three-fold cross validation. In the results obtained, approximately 71.9% of the images were classified correctly. In this study, we have evaluated 3 fine-tuning DCNNs including AlexNet, GoogLeNet, and VGG-16 to improve accuracy of classification. AlexNet consists of 5 convolutional, 5 pooling, and 3 fully connected layers; the last layer was modified to classify 3 lung cancer types. Overall accuracy was 75.5%. GoogLeNet possesses 22 layers without fully connected layers with modification to output 3 cancer categories. Accuracy was as low as 70.8%. VGG-16 is constituted with 16 relatively simple layers and resulted in the best value of 76.8% in accuracy. Taking into account these data, fine-tuning, although depending on the architectures, could be useful for classification of lung cancer cytological images.

Curriculum Vitae

1987	M.D., Mie University School of Medicine, Tsu, Japan
1991	Ph.D., Mie University Graduate School of Medicine, Tsu, Japan
1997-2009	Section Head, Division of Oncological Pathology, Aichi Cancer Center Research Institute, Nagoya, Japan
2011-	Department of Diagnostic Pathology, Fujita Health University School of Medicine, Toyoake, Japan

W-8) Nagasaki-Kameda digital pathology network – Establishing a role model for primary diagnosis and multidisciplinary team consultation with effective educational attainment.

Andrey BYCHKOV, et al.

Director,
Department of Digital Pathology,
Kameda Medical Center, Kamogawa, Chiba Prefecture

Keywords; Pathology, Routine practice, Network, Conventional, Digital, WSI

Abstract
Evolution of whole-slide imaging (WSI) technology in the last two decades significantly impacted pathology practice. Implementation of digital pathology (DP) into the routine diagnostic environment is a current worldwide trend. Japan has been at the forefront of DP technology since the early 1990s. However, adoption of these advancements into daily pathology practice has not been widely achieved. Here we report our experience with deep integration of DP into routine workflow of the academic center and networking hospitals, which was aimed to facilitate primary diagnosis, multidisciplinary team consultation, and education.
Nagasaki-Kameda DP network connecting academic institution (Nagasaki University Hospital), large-scale hospital (Kameda Medical Center), and several independent and affiliated centers, was established in 2017. Currently, when optimization phase is completed, the network is effectively employed on the "all day round" basis. Telepathology activities include remote sign-out sessions for primary diagnosis (three per day), tumor boards, multidisciplinary team consultations, journal clubs, research progress meetings, and regular international web conferences. WSI-based education essentially incorporated into all telepathology activities is highly attractive for pathology residents, rotating clinical fellows, and undergraduate medical students. Noteworthy, this DP model considers immediate adoption of AI/deep learning technologies for diagnostic and research purposes. Our next goal is a transition to 100% digital, which is expected to be accomplished in 2018.
Smooth integration of WSI in routine pathology workflow is achievable in short time. Nagasaki-Kameda DP network can serve as a role model for primary diagnosis and multidisciplinary team consultation with effective educational attainment, which can be adopted by other institutions in Japan and abroad.

Curriculum Vitae

2002	M.D., Smolensk State Medical Academy, Smolensk, Russia
2013	Ph.D., Nagasaki University Graduate School of Biomedical Sciences, Nagasaki, Japan
2005-2009	Assistant Professor, Dept. Pathology, Smolensk State Medical Academy, Smolensk, Russia
2007-2009	Assistant Professor, Dept. Pathology, Smolensk State Medical Academy, Smolensk, Russia
2013-	Senior Research Fellow, Dept. Pathology, Chulalongkorn University, Bangkok, Thailand

W-9) **How to progress the digital pathology in Japan**

Yukako Yagi, PhD

Associate Profeffsor,
Head, Pathology Digital Imaging Laboratory
Department of Pathology, Memorial Sloan Kettering Cancer Center, NY, USA
Directir of Digital Pathology, the Warren Alpert Center for Digital and Computational Pathology at MSK
Adjunct Associate Prof. the Institute of Innovative Research, Tokyo Institute of Technology
Keywords; Keywords; Pathology, Digital, WSI, AI

Abstract

After about 20 years after we have started developing the first whole slide imaging scanner, finally, the FDA cleared the one of whole slide imaging system for primary diagnosis in US. However large scale adoption has not started yet because many other conditions have to be evaluated and establish for the WSI system adoption.

The ideal WSI system integration in clinical workflow is vary by country, a type of hospital, size of hospital and so on. The most important thing for successful implementation is to have a clear goal of the own digital pathology and have deep knowledge technically and clinically to select the right systems, establish the right team within institution not only within pathology department, and to find the right resources to achieve the goal. Often, we have limited resource. There are always solutions to overcome any limitation.

At, MSK currently creates about 30,000 digital slides per month, composed of in house surgical pathology cases, cytology cases, hematopathology cases, consult cases, and frozen sections, selected by pathologists and flagged for digitization by a sticker attached to the slide. To date, approximately 500,000 digital slides are available. The goal this year is to create 40,000 digital images per month and start scanning MSK's glass archives; approximately 4MM slides. All scanned data are saved at MSK's data center in New Jersey

However, for now, primary diagnosis is not in the digital pathology playbook at MSK. If we want to use it for primary diagnosis, we will have to have the FDA-approved system. However, to integrate a WSI system with our laboratory information system takes time, effort, and cost to complete, but in our case very important. We anticipate that the FDA-approved scanner and the 'best fit' scanner in our current workflow may not always be the same. Based on our experience at MSK, the best system for us is the one that fits with our workflow and best scans our pathology materials.

We are always having discussions and ultimately want to do what's best for ensuring patient safety, safe practices, and optimal patient care. Currently our team are focused on building the framework and evaluating and validating new scanners; having gained much experience and also developing models for using archived and annotated data for computational pathology; exploring, evaluating, and optimizing new technologies, including 3D imaging; and improving system integration.

This basic concept could apply to any institution in any country although the scale might be very different.

W-10) Digital Pathology in Japan, Its Evolution and Future

Yasunari TSUCHIHASHI, M.D., Ph.D.

Head, Department of Clinical Pathology,
Louis Pasteur Centre for Medical Research, Kyoto, Japan
Keywords; Pathology, Digital, WSI, AI

Abstract

Our Japanese Society of digital pathology (JSDP) evolved from its former organization, Japanese society of telepathology and virtual microscopy that had evolved from the mother organization, the Japanese society of telepathology, established in 25th Aug. 2001, in Tokyo.

We realize that almost all the key technologies for digital pathology derived from telepathology, which is pathology practice in a distance, and its essence is electronic handling of pathology diagnosis. In the last two decades the name of our society changed and changed reflecting its evolutional steps following quick and never ending innovations of technologies.

The main evolutional steps were analogue to digital shift of image information systems in the early 1990's, optic fiber network development in the late 1990's, adoption of factory automation technologies for WSI scanner development in the early 2000's, various soft fare development for image analysis in the late 2000's and use of artificial intelligence for auto-diagnosis in progress in the 2010's, etc.

Electronic pathology now depends almost solely on digital systems and its main applications shifts from quick frozen intraoperative diagnosis to routine primary diagnosis in a hospital, and from education and research to routine diagnostic practice.

Now "the distance" is not a matter for pathology practice and our challenge is to fully digitize all the pathology workflow in a hospital, i.e., reception of specimens, processing them into glass slide preparation, digitize the images of slide specimens, diagnosis on monitors, measurements on images and/or supports from diagnostic intelligence if necessary, generation of electronic pathology reports, and archiving the pathology reports for educational and conference purposes, etc.

Integration of pathology information system (PIS) into hospital information system (HIS) is mandatory. Digital solutions in pathology laboratories will enable more accurate, more objective and faster pathology diagnosis that will be realization of national welfare, provided that cost issues are solved.

Curriculum Vitae

1976	M.D., Kyoto Prefectural University of Medicine, Kyoto, Japan
1982	Ph.D., Kyoto Prefectural University of Medicine, Kyoto, Japan
1982-2001	Associate Professor, Department of Pathology, Kyoto Prefectural University of Medicine, Kyoto, Japan
2001-	Head, Department of Clinical Pathology, Louis-Pasteur Centre for Medical Research, Kyoto, Japan

抄録
日本デジタルパソロジー研究会はその前身、日本テレパソロジー・バーチャルマイクロスコピー研究会から発展したが、さらにその元は２００１年８月２５日、東京で設立された日本テレパソロジー研究会である。デジタルパソロジーで用いられている技術のほとんどはテレパソロジーの開発によりもたらされたものである。テレパソロジーは遠隔状況での病理診断であるが、その本質は病理診断を電子的に行なうことに他ならない。過去２０年間、われわれの研究会はその名称を変え乍ら発展して来たが、その名称変更は夫々の時期における技術革新を反映したものであった。1990 年代前半にはカメラやモニターといった画像情報システムがアナログ式からデジタル式にシフトした。1990 年代後半には光ファイバー網が普及した。2000 年代前半にはファクトリーオートメーション技術が活かされた whole slide imaging (WSI) scanner が開発された。2000 年代後半にはモニター診断における種々の画像解析ソフトが開発され、さらに人工知能を利用した自動診断開発につながって来た。電子的手段による病理診断の適用は、初期の術中迅速病理診断支援から、病院内におけるルーチンの一次病理診断にシフトして来た。最早 ”遠隔” という状況設定は病理では問題ではなく、検体受付から標本作製を経て診断が発行されるまでの全ての病理ワークフローをデジタル情報化することが課題となっている。その上で病理情報システムが病院情報システムに統合されることは必須となる。経済的課題が解決されるならば、病理診断のデジタルソリューションは、より正確で、より客観的で、より早い病理診断を実現することとなる。それは国民の願いとなろう。

U-1) Current State of Digital Pathology, Digital Pathology Association and Building a Brighter Digital Future Takes a Village

Marilyn M. Bui, MD, PhD

Professor of Pathology at Moffitt Cancer Center, USA
Keywords; Pathology, Software, Image analysis, Digital, AI

Abstract
Digital Pathology (DP) continues to evolve as a powerful tool that enhances the delivery of precision medicine by pathologists and scientists. FDA approval of the first whole slide imaging system for primary diagnosis signaled a turning point showing digital pathology is a proven and valuable methodology for pathologists. Hardware platforms have matured, but the software continues to innovate with a new focus on image analysis and workflow efficiency. Artificial intelligence is showing great potential in providing a companion diagnostic tool for precision medicine. This introductory section will review these changes and set the stage for discussions on further advances in digital pathology. Digital Pathology Association (DPA)'s mission is to facilitate education and awareness of digital pathology applications in healthcare and life sciences. Pathology Visions is the annual scientific meeting of the DPA. Through its leadership and membership, DPA has made significant contribution to the advancement of digital pathology. The highlight of DPA's accomplishments, including the most recent NSH/DPA Digital Pathology Certificate Program, lessons learned and future opportunities will also be discussed.

Biography
Marilyn M. Bui, MD, PhD is a Professor of Pathology at Moffitt Cancer Center, a top ranked comprehensive cancer center in America. She is the Scientific Director of Analytic Microscopy Core, President of Medical Staff, Director of the Cytopathology Fellowship, and departmental Education and Digital Pathology lead. Dr. Bui is the President-Elect of the Digital Pathology Association (DPA), Vice Chair of the College of American Pathologists (CAP) Digital Pathology Committee, and an editorial board member of Journal of Pathology Informatics. Dr. Bui also chairs the CAP Quantitative Image Analysis (QIA) of HER2 Immunohistochemistry (IHC) for Breast Cancer expert panel which is developing an evidence-based guideline to improve accuracy and reproducibility of the interpretation of HER2 IHC by QIA. She has published over 160 peer-reviewed articles, 15 book chapters and two books. She has received national and institutional awards in cancer research, education and service. Digital pathology has significantly helped Dr. Bui in delivering better patient care through cancer diagnosis, research and education.

U-2) Whole Slide Imaging and Digital Pathology Guidelines in the United States.

Douglas J. HARTMAN, MD

Associate Professor,
Pathology and Director of Division of Pathology Informatics,
Pittsburgh Medical Center University, USA
Keywords; Pathology, Routine practice, Digital, WSI, AI

Abstract
In April 2017, the first Food and Drug Approved digital pathology vendor was approved in the United States. This approval was the manifestation of years of lobbying work by the Digital Pathology Association and pathologists. Several guidelines have been published to aid in the implementation within the United States – notably from the College of American Pathologists. We have begun implementing digital pathology for routine diagnostic work at our institution. The aim of this presentation is to review the workflow changes we executed, the validation work that we performed and to point out how they simultaneously introduced safer and better quality practices for the histology lab. A digital pathology solution was implemented at our institution comprised of both academic and community hospitals. Digital pathology was deployed to satisfy routine clinical diagnostic work, research studies, and educational use cases. Many changes need to be made within the laboratory besides the purchase of hardware and software to maximize implementation of digital pathology for routine pathology work. There are several regulatory requirements that must be addressed during the implementation process. Additionally, addressing key pre- and post-processing changes should be part of a successful implementation.

Biography
Dr. Douglas J. Hartman is the Associate Director of the Division of Pathology Informatics at the University of Pittsburgh Medical Center (UPMC) and a gastrointestinal pathologist. He has been implementing digital pathology for primary signout as well as for telepathology at UPMC. He is the director for Image Analysis at the University of Pittsburgh Medical Center and has developed several image analysis assays. He has developed a smartphone application titled "Pocket Pathologist" for the rapid submission of consultations using a smartphone. Dr. Hartman has also been a leader within the UPMC health system in assessing the recent Safety Assurance Factors for EHR Resilience guidelines released by the United States Office of National Coordinator for Health Information Technology. Dr. Hartman's research in informatics is varied but focuses on practical application of informatics. He has published on informatics topics and given national talks based on his informatics work.

U-3) **Current state of WSI and Artificial Intelligence for clinical diagnostics**

Anil V. PARWANI, MD, PhD, MBA

Professor
Pathology and Biomedical Informatics
Ohio State University Wexner Medical Center, USA

Keywords; Pathology, Digital, WSI, AI

Abstract
Whole slide imaging (WSI) is becoming increasingly in use for clinical applications such as teleconsultation, pathology education, research and academia. Technological advancements in current WSI scanning devices have increased the capability to handle and scan hundreds of slides automatically per day. With this scanning and handling capacity increasing, utilization of WSI in clinical settings for primary diagnosis is becoming more feasible. WSI scanner technology has greatly advanced and the digital images they produce are of diagnostic quality. These high quality images are now amenable to be used in artificial intelligence/deep learning algorithms for quantitative and qualitative assessment of important features for diagnosis and prognosis such as tumor grading and searching for micromets in a lymph node. This session is aimed at providing participants with an update on the current state of WSI and its clinical applications including leveraging these technologies for building deep learning/artificial intelligence algorithms. There will also be discussion surrounding the challenges in implementing WSI and AI in the pathology laboratory.

Biography
Anil Parwani is a Professor of Pathology and Biomedical Informatics at The Ohio State University. He also serves as the Vice Chair of Anatomical Pathology and Director of Division of Pathology Informatics and Digital Pathology. Dr. Parwani is a world leader in digital pathology and has led the way in the implementation of these technologies in several key clinical areas. He also has expertise in the area of Anatomical Pathology Informatics including designing quality assurance tools, biobanking informatics, clinical and research data integration, applications of whole slide imaging, digital imaging, telepathology, image analysis, artificial intelligence and lab automation. Dr. Parwani has authored over 280 peer-reviewed articles in major scientific journals and several books and book chapters.

<<ポスター発表/ POSTER SESSION>>
9 月 1 日午後 2 時-3 時半/ Sep. 1st, 2:00−3:30 pm

P1 (日本語発表/ Presentation in Japanese) 2:00-2:10 pm
BioBank system を用いた遺伝子解析の手法の確立とデジタルパソロジーとの統合
(Establishing the way of extracting DNA with BioBank kit and integration with digital pathology)

古川雅大(医学部学生)、二口充、早田正和、福岡順也
Masahiro FURUKAWA(student), Mitsuru FUTAKUCHI, Masakazu SODA, Junya FUKUOKA
長崎大学大学院病理学講座
(Department of Pathology, Nagasaki University Graduate School of Biomedical Sciences)
長崎病理医育成・診断センター
(Nagasaki Educational and Diagnostic Center of Pathology(NEDCP)

抄録
【背景】

遺伝子発現に基づいた新規抗癌剤が精力的に開発されており、それに伴って、がん組織を用いた分子病理学的解析が重要となってきた。

がん組織からDNAやRNAを採取するには、凍結組織を用いるのが最も効率的ではあるが、後ろ向き研究をするには、蓄積されたパラフィン組織からDNAを抽出し解析することが重要となる。

我々の開発したBioBank systenはパラフィンブロックから厚切り切片を作成し、フィルムで保護するもので、パラフィンブロックを損傷させることなく、組織像と対比させることで必要な組織のみを簡便に切り出すことを可能とし、スキャンされたデジタルデータと分子情報の統合に適したツールである。

本研究の目的は、BioBank systemを用いた分子病理学的解析を実施することで、その有用性およびデジタルパソロジーとの親和性を示すことである。

【方法】

BioBank sheetを用いた未染切片を作成し、隣接したH.E.標本のWSIイメージを参照して、厚切り切片上での腫瘍組織をマッピングし、ハサミで腫瘍組織を切り出す。脱パラを行いDNAを抽出し、腫瘍成分の割合を高めたDNAサンプルを作成する。

さらに、GAPDH、腺癌の腫瘍細胞に発現しているTTF1および肺癌に特異的な変異であるKRASの発現をRT-PCRを用いて解析し、KRASの変異が検出可能となるBioBank sheetの厚みを同定する。

【結果】

一定量のBioBank sheetを用いることで、GAPDH, TTF1の発現およびKRASの変異を検出でき、GAPDHおよびTTF1の発現が検出できる厚さは、KRASの変異を検出できる厚さより厚くなると予想される。KRASの変異を効率よく解析するには、厚切りのBioBank sheetから病理情報によりエンリッチされた腫瘍組織をサンプルすることが重要と言える。

【考察】

BioBank sheetとデジタルパソロジーを融合することで、1）簡便にFFPEブロックを用いた分子病理学的解析が可能となり、2）腫瘍組織のenrichmentを簡便に行うことで、腫瘍組織内の変異を効率良く解析でき、3）BioBank sheet 厚切り未染標本の簡便に管理し、FFPEブロックを破損させることなく、組織サンプルを外部の共同研究機関に送付することが可能となる

これにより既に死亡した患者のサンプルを解析し、生存率あるいは生存期間に関する後ろ向き研究が行いやすくなるといった効果がもたらされると期待している。

P2 (日本語発表/ Presentation in Japanese) 2:10-2:20 pm

Panoptiq (ViewsIQ)を用いた Whole slide image (WSI)を利用した細胞診検診業務の実際

小菅則豪 1), 青山肇 1), 黒島義克 2,3)、大竹賢太郎 3), 吉見直己 1)
琉球大学大学院医学研究科 腫瘍病理学講座1)、中部地区医師会検診センター 八重山出張所2)、臨床検査課3)

Key words; Cytology, Routine practice, Network, WSI

抄録

【はじめに】中部地区医師会検診センターでは、県内年間 3 万件の細胞診検査を受託し、細胞診検査士の人員配置のため沖縄本島から石垣島にある八重山出張所へ毎週 350～500 件を搬送し、スクリーニングを行っている。ただし島内およびセンターに専門医は不在で、陽性症例に関しては精度管理上細胞診専門医のいる琉球大学へ搬送して確定している。今回、Panoptiq (ViewsIQ)による Whole slide image (WSI)による細胞診の可能性を検討した。そのときの結果までの時間(Turn around Time : TAT)の検証も行ったので報告する。【材料と方法】子宮がん検診受診者の LBC 標本(SurePath 法)陽性例を Panoptiq (ViewsIQ)を用いた WSI で判定(WSI 法)と通常プレパラート判定(従来法)を、ランダムに 3 ヶ月に亘り、各 80 症例実施した。遠隔での診断は ViewsIQ 社のクラウドサーバーないし TeamViewer ソフトによる画面共有を用いた。従来法は細胞検査士が判定後に鏡見で判定し、両者の判定を比較検討した。【結果・考察】WSI では、ASC-US 以上の異常検体症例の場合はスクリーニング時間の増加を示したが、NILM の症例では時間に差は認めなかった。なお、専門医に回される症例に関しての TAT は大幅に短縮された。専門医による診断一致率は、的中率が平均して 77.5%であったが、3 ヶ月の経験と経過で、コーエンの κ 係数の上昇、診断時間の短縮がみられ、デジタルパソロジー利用の慣れによる精度の向上が示された。課題としては、不適切となった症例では、標本に出現する、厚みの違いが標本全体にピントのずれを生じることが挙げられた。

P3 (Presentation in English) 2:20-2:30 pm

Telepathology – Past, Present and Future in Mongolian steppe

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Key words; Pathology, Routine practice, Network, Conventional, Digital

Abstract

Past (History): In the late 2000s we started an International static Telepathology project in Mongolia at very first time (about 580 cases) along with a consultation service with Pathology Institute at Basel University Hospital in Switzerland (total of 390 cases). This was through simple standardized digital camera-microscope set (by DEZA Project) and store and forward technology (SST & UNFPA Mongolia project). This is the foundation of our current Tele-Pathology practice model.

Present: Just like many academic institutions we are utilising whole slide imaging by Japanese investigators (JICA-Gov. of Mongolia co- project of building a Teaching hospital) at the New Pathology department of University Hospital, which is willing to be open on October 2018. This will mostly utilise for remote consultation services, and quality control measures as well as for storage.

Mongolian e-Medicine Center NGO, The centre's aim is to contribute with:
Development and implementation of E-Health solutions and services that realize the potential in Mongolian health sector. (Hip US-Tele screening project of newborns; Millennium Challenge Corporation project in Mongolia for cervical and breast cancer screening; Master service providing under USRAD agreement.

Future:

- Integration of the Reference Pathology Laboratory. Existing Tele-pathology network throughout the nation-wide and international partners are the backbone of our growth
- To develop a Digital Pathology Teaching Lab as Pathology Learning module with University e-Learning platform
- Primary diagnostic services as it is becoming a common practice
- Quality control measures
- Constant remote Consultation services
- Virtual storage of digitised slides

P4 (Presentation in English) 2:30-2:40 pm

Evaluation of Malignant Colorectal Polyps Using Desmin Immunohistochemistry and Virtual Slide Image.

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Key words; Pathology, Routine practice, Case study, Conventional, Digital, WSI

Abstract

Background:

When a component of adenocarcinoma is detected in a colorectal polyp, it is important to determine whether the malignancy is intramucosal (Tis) or shows submucosal invasion (T1). Performing desmin immunohistochemistry may help clarify the invasion status. In the esophagus and stomach, measurement of invasion depth beyond muscularis mucosae may influence the decision of conservative versus aggressive treatment. Whether such measurement can be reliably applied to malignant colorectal polyp specimen and be used to guide surgical decision is not well characterized. Applying virtual slide image technology in this scenario may increase measurement precision and consistency.

Methods and Results

A total of 56 endoscopic biopsy cases diagnosed as colorectal tubular adenoma with adenocarcinoma were retrieved from the archive of a single medical center from 2016 to 2017. Desmin immunohistochemistry was performed, and the H&E slide and the immunohistochemistry slide were both scanned using a Hamamatsu S210 whole slide scanner. The glass slides and virtual images were reviewed by two gastrointestinal pathologists and one pathology resident to determine the invasion status (T1 or Tis), invasion depth and distance to margin. The reviewers were blind to patient information and prior pathological diagnoses.

The overall invasion status concordance rate among the three pathologists is 79% by reviewing H&E slides, 80% by reviewing desmin immunohistochemistry slides, and 84% by reviewing virtual slide images of both. Only 15 cases were judged to be fit for invasion depth measurement, and 12 cases for distance to margin measurement by all three pathologists. Among these measurements, the standard deviation of the invasion depth on average represent 27% of the mean, while the standard deviation of the distance to margin represent 36% of the mean.

Conclusion:

Using the virtual slide image improves invasion status diagnosis concordance rate between pathologists. However, the measurement of invasion depth and distance to margin of malignant colorectal polyps was highly variable and only applicable to a portion of cases, even with the assistance of desmin immunohistochemistry and virtual slide images. The inconsistency and limitation in measurement indicates that invasion depth or distance to margin are not suitable guides to malignant colorectal polyp patient management decision.

P5 (Presentation in English) 2:40-2:50 pm

Application of Online Videos Linking with QR Codes Establishes A Novel E-learning Platform in Cytopathology.

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Key words; Cytology, Educational, Network, Digital

Abstract

Background:

Traditionally, education in cytopathology is delivered using textbooks, glass slides, and conventional microscopy. Recently, the application of web-based E-learning platforms has been dramatically expanded. In addition, the social media such as Facebook, YouTube, etc. are widely used in our daily lives. If we could apply these modalities in our teaching activity, we might make the cytopathology education more accessible and efficient.

Methods and Results:

Step 1: Record the realtime microscopic teaching video and share it online.

We connect the multi-head microscope (Eclipse 80i, Nikon) with a digital camera (Digital Sight DS-Fi2, Nikon) and a microscope camera controller (Digital Sight DS-L3, Nikon). We capture the live images using the imaging software (NIS-elements F Ver4.60.00, Nikon) and record the realtime teaching using screen recorder (Screencast-O-Matic) in a laptop. Afterwards, we upload the teaching video on Youtube and share the link on Facebook cytopathology club.

Step 2: Generating a QR code for a specific teaching slide.

A specific section of Youtube teaching video is chosen for teaching purpose and the QR code of the link is generated by a QR code generator. Each teaching slide is accompanied with a specific QR code. Students, trainee, cytotechnologists or cytopathologists can use their mobile device to scan the QR code and get access to the specific Youtube video demonstration. This works as a video guide while studying the teaching glass slides under light microscope.

Results:

Constantly, over 250 cytotechnologists/cytopathologists (approaching one-third of all the qualified personnel in Taiwan) are frequent users of these learning platforms. They could get access and learn any interesting, rare, or typical teaching cases at any place and at any time.

Conclusions:

We established a novel E-learning platform by application of online videos linking with QR Code labeling to share cytopathology teaching video. Everyone who wants to learn cytopathology, they could easily get access and learn any interesting, rare, or typical teaching cases at any place and at any time without the barriers associated with traditional video equipment and standard classroom/conference or glass slide settings.

P6 (Presentation in English) 2:50-3:00 pm

Analyzing method for the digital colonic tissue images via topological concept
(位相幾何学的手法を用いた大腸組織解析技術について)

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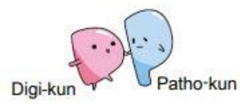
Key words; Pathology, Software, Image analysis, Digital, WSI

Abstract
A region of interest (ROI) is a part of tissue that contains important information for diagnosis. To use many image analysis methods efficiently, a technique that would allow for ROI identification is required. For the colon, ROIs are characterized by areas of stronger color intensity of hematoxylin. Since malignant tumors grow in the innermost layer, most ROIs will be located in the colonic mucosa and will be an accumulation of tumor cells and/or integrated cells with distorted architecture. Homology is a mathematical concept that can quantify the contact degree. Due to the lack of contact inhibition of cancer cells, an area with unusual contact degree is expected to be a potential ROI. The current work verifies the accuracy of this method against the results of pathological diagnosis, based on the 50 WSI (whole slide image) colonic images provided by the Osaka International Cancer Center and University Hospitals Coventry & Warwickshire. Statistically, we obtained quite high accuracy results. In this presentation, we will explain the mathematical method and show the results. This system could be used to screen for colon cancer.

抄録
ROI(region of interest)とは、診断のための重要な情報を含む組織の一部の事を言う。画像解析を有効に用いるためには、まず ROI を先に抽出する技術が必要である。大腸の場合、ROI は、ヘマトキシリン強い色強度の領域によって特徴付けられるが、悪性腫瘍は最内層で増殖するので、ほとんどの ROI は大腸粘膜に位置し、腫瘍細胞の蓄積および/または歪んだ構造の統合細胞となる。
ホモロジーとは、接触度を定量化できる数学的概念であるが、がん細胞の接触阻害の喪失のために、接触度が異常な領域は潜在的に ROI であると予想される。現在の研究では、大阪国際がんセンターとウォーリック大学病院で提供された 50 WSI(全スライド画像)大腸画像に基づいて、ホモロジー法を用いた結果を紹介する。統計的には高い精度の結果が得られているが、ここでは数学的方法を説明し、その結果を示す。将来には、このシステムをスクリーニングに使用することが可能になると思われる。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