Summary of the 4th Nordic Symposium on Digital Pathology

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Abstract

The Nordic symposium on digital pathology (NDP) was created to promote knowledge exchange across stakeholders in health care, industry, and academia. In 2016, the 4th NDP installment took place in Linköping, Sweden, promoting development and collaboration in digital pathology for the benefit of routine care advances. This article summarizes the symposium, gathering 170 attendees from 13 countries. This summary also contains results from a survey on integrated diagnostics aspects, in particular radiology-pathology collaboration.

Keywords: Digital pathology, implementation, pathology informatics

Introduction

While the benefits of digital pathology in routine clinical use continue to inspire initiatives around the world, some European countries are arguably ahead of the curve. There are now a number of sites using digital pathology for primary diagnostic review, for example, in Sweden, the Netherlands, Finland, Lithuania, and Denmark. The Nordic symposium on digital pathology (NDP) was created in 2013 to promote exchange of state-of-the-art knowledge. The pioneering experiences in Sweden1 have been a sounding board for the care providers moving in the same direction.

In contrast to research use of digital techniques, NDP specifically targets the clinical adoption of whole-slide imaging (WSI) and other digital technologies. While there appears to be broad consensus on the opportunities that lie ahead, there are also many obstacles on the path toward materializing those benefits. A foundational motivation for the symposium is that effective progress is dependent on tight collaboration between health care, industry, and academia. Judging from the attendees evaluations from this and previous years, this type of venue with ample room for interactive discussions is highly appreciated and much needed. Here, we provide a summary of the NDP 2016, in the form of a meeting overview, results from the symposium’s integrated diagnostics workshop, speaker contributions, and finally brief conclusions.

Meeting Overview

The 2016 NDP symposium took place on November 8–9, 2016, in Linköping, Sweden. A total of 170 attendees gathered, of which 47% listed health care as the primary affiliation, 35% industry, and 18% academia. Pathologists constituted the lion share of health care representatives, with managers, laboratory technologists, and information technology (IT) staff also being well-represented categories. The participants represented 13 different countries across Europe, Asia, and North America, with the Nordic attendees being a large majority (88%).

A large part of the program was devoted to invited talks and a workshop on integrated diagnostics. The contents of these sessions will be outlined in the sections below. In the science and innovation session, 12 posters were presented, with contributions from groups in Linköping, Bremen, Tampere, Uppsala, Lund, and Norrköping. The NDP also included an industrial exhibition with 12 vendors, showing a wide range of digital pathology products and services. Figure 1 shows a snapshot from the symposium and the program details are available at the NDP website www.ndp2016.se.

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Workshop on Integrated Diagnostics

A central component of this year’s NDP was a workshop discussing collaboration between radiology and pathology and how digital tools relate to developments in this area. A survey was distributed in advance of the symposium and presented in the session. Key results from this survey will be presented next.

It is important to note that the survey respondents represent a biased selection among the pathology community. Since only NDP participants were asked, this means that respondents are likely to be among the most positive to digital pathology and also among the most experienced. There is also strong geographical dominance from the Nordics and, in particular, Sweden. Out of 79 asked to participate in the survey, 58 responses were gathered. The distribution of roles is given in Figure 2. It is likely that the questions that require deep knowledge of clinical practice were dominated by pathologists as those questions to a substantial extent were skipped or received “I don’t know” responses.

The survey first asked, “Today, to what degree do you use digital images of histology slides in your practice? (In percentage of all histology cases).” The results are shown in Figure 3, for instance that a majority of respondents report substantial use of digital imaging in primary diagnostics (Another bias to note for these questions is that several people from the same institution may have responded).

The main theme of the survey was integrated diagnostics, i.e., the idea of closer collaborative work practices between pathology and radiology. Such proposals have been voiced over the years[4,5] and appear to be gaining traction in the respective communities, likely fueled by the increasing possibilities arising when pathologists also work in a primarily digital environment. To the end of forming a baseline, the survey asked pathologists, “How often do you have direct interaction with a radiologist regarding a patient case?” Figure 4 shows the results, painting the picture that multidisciplinary team meetings are where the interaction primarily happens but also that the direct interaction overall is low. One could argue that computer chat would be a very convenient and efficient way of interdisciplinary communication as it has proven to be within radiology settings. The low use may, however, merely be a sign that appropriate IT tools are currently missing.

The respondents were also asked to imagine well-crafted future collaboration support in the form of new IT tools and workflows, and in that environment assess the potential: “What impact will pathology-radiology collaboration have?” The impact within different areas is presented in Figure 5. Overall, the NDP attendees were very positive about the potential, in particular, about the possibility for deeper discussion on diagnosis discordance.

The survey results were presented as a segway into a panel discussion. The panel members were Prof. Inger Nina Farstad (Oslo, Norway), Dr. Brendan Devlin (Altnagelvin Hospital, Londonderry, United Kingdom), Dr. Anna
Bodén (Linköping, Sweden), Prof. Peter Hamilton (Belfast, United Kingdom), Assoc. Prof. Jeroen van der Laak (Radboud University, Nijmegen, the Netherlands), and Prof. Richard M. Levenson (UC, Davis, USA). Some of the main points brought forward were as follows: The underlying technology is there, now we need to focus on integrating them into workflows and good user experiences (Prof. Hamilton); It is important to step out of the “back office” mindset and actively contribute to shaping the best possible care chain for the patient (Dr. Devlin); Integrated diagnostics should also be seen in the broader perspective of regional/national integration (Prof. Farstad); It is vital to avoid misdirected diagnostic activities – the diagnosticians should challenge any request they believe to be unnecessary (Dr. Devlin); An attractive concept is to have a “Maitre d’” for diagnostics, a new role guiding diagnostic paths and providing effective single-point communication to referrers (Prof. Levenson).

The overall conclusion from the panel and the discussion with the NDP attendees is that closer collaboration between pathology and radiology is a positive and important development track going forward.

**Speaker Contributions**

Prof. Levenson, UC, Davis, was the first keynote speaker of the symposium. Levenson presented the latest achievements with slide-free microscopy technology based on ultraviolet (UV) excitation. The technology, dubbed microscopy with UV Surface excitation, allows direct depiction of unsectioned specimens at full microscopic resolution. Levenson demonstrated many case examples also including image features not represented in traditional staining and microscopy, including three-dimensional tissue information, features whose diagnostic value is now being explored. Along another vein, Levenson shared insights on using trained pigeons as unbiased proxies for human visual pattern recognition in pathology, work which was both humorous and thought-provoking.

The second keynote speaker, Associate Prof. Jeroen van der Laak, Radboud University, provided ample insight into state of the art in image analysis for WSI. Among other topics, van der Laak shared result details from the recent grand challenge, called CAMELYON16, in lymph node metastasis detection. The research challenge encompassed a whole-slide task, in this sense closer to the clinical reality than previous challenges, and leading results demonstrated levels of accuracy in line with human assessment. Of interest, however, was that machines were being compared with the ultimate human effort (i.e., the painstaking detailed microscopic review of every part of the lymph node, something not always feasible in clinical practice). In tandem with those promising results, van der Laak emphasized the demanding efforts still needed to bring the algorithms into the everyday clinical context.

Image analysis methods were presented also by two other invited speakers. Associate Prof. Johan Hartman, Karolinska Institutet, presented work concluding that computational analysis outperformed manual assessment for breast cancer subtyping. For example, the image analysis algorithm showed higher sensitivity and specificity for the luminal B subtype, being considered a very challenging distinction. Prof. Arvydas Laurinavicius, Vilnius University, spoke to the distinct prognostic value of bimodality of Ki67 expression - an analysis requiring computational methods. Instead of restricting proliferation measures to a hotspot, Laurinavicius showed results where heterogeneity across the slide proved to be a more powerful survival indicator in breast cancer. He also shared his group’s experiences on running routine primary review using telepathology, with several colleagues reporting routine clinical work remotely.

Two speakers provided valuable advice regarding digitization based on radiology experiences. Associate Prof. Peter van Ooijen, University Medical Center Groningen, described the challenges an informatician will meet, ranging from overarching strategic efforts to mundane pragmatic problem-solving. A key takeaway was the importance of adopting and enforcing standards when building an effective and robust digital system. Dr. Devlin, Altnagelvin Hospital, presented the journey to a fully digitized national radiology system in Northern Ireland. Apart from advice on handling technology and workflow change, Devlin emphasized the need to establish direct support from stakeholders in top leadership layers.

Dr. Bethany Williams, Leeds University, contributed to the ongoing efforts in WSI validation by presenting a systematic analysis of the type of cases where discordance with microscopic review has occurred and what can be learned from them. Among the most challenging areas were diagnosis of dysplasia and finding small objects (e.g., micrometastases). Williams suggested possible reasons for the discrepancies and mitigation strategies.

NDP also included a number of special sessions. Four lectures were organized by industrial contributors. Tieto Sweden had invited Theo Papaioannou from the Västra Götaland Region, Sweden, to present their ongoing large-scale digitization project. From Philips, Dr. Hamilton presented computational imaging solutions and insights on remaining challenges for digital pathology in the context of workforce shortages and the need to collaborate. Dr. Jesper Molin from Sectra presented key
takeaways from his PhD thesis, devoted to new opportunities for pathologist interaction in digital image review. Finally, Dr. Per Hertz from Eizo Nordic discussed the importance of high and controlled display performance in the context of diagnostic quality. Finally, a seminar on implementing digital microscopy in medical education was hosted by Clinicum, Linköping University.

Conclusions

The 4th NDP symposium reflected a digital pathology community that is maturing. The topics covered have evolved from entry-level concerns about how to scan slides properly, or whether complete digitization is possible, to mature discussions on how to design systems and workflows to accomplish quality and productivity gains – gains that are undisputed. As in previous years, the attendees expressed the great value of this experience sharing across organizations, disciplines, and sectors.

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Conflicts of interest

Claes Lundström is an employee of the company Sectra AB. Anders Persson is a board member for Sectra AB. Darren Treanor is a member of the Aperio/Leica Advisory Board and the Sectra Advisory Board. Marie Waltersson has no competing interests to declare.

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