

PathLAKE

Computational Pathology Excellence



Professor Nasir Rajpoot
Co-Director & Warwick PI

"The 2020 summer will be remembered for many things in our living history, not least for the challenges it posed to the normal work-life balance due to most people working from home and away in isolation. Nevertheless, I am very proud of the way our team has carried itself through these challenging times and continued working very hard to ensure that the project objectives are met in a timely manner as much as possible.

As the COVID pandemic continues to pose further challenges for creative development that has always relied on face-to-face meetings for brainstorming, we continue our struggle to find innovative ways to collaborate efficiently and have fun at the same time."

Contents

Ongoing project information.....	2
Publications	3
Congratulations	4
Impact of Covid-19 & Wellbeing	5
Recruitment & upcoming news.....	6

As the Persian proverb goes,
"this too shall pass."

Ongoing project Information

● AI DEVELOPMENTS

Our state-of-the-art algorithm for gland and lumen segmentation is ready for WSI level inference. We have also made significant progress on the prediction of slide labels using a cutting-edge weakly supervised algorithm. Research work is ongoing on simultaneous segmentation of regions and classification of cells in a more efficient and accurate manner. Thanks to our wonderful research staff for their dedicated efforts on this front.

● PATHLAKE DATA LAKE (PDL) AND PATHLAKE ANALYTICS ENGINE (PAE)

The design for PDL and PAE have now been approved and near completion after many months of hard work. Thanks to Young and John for leading the work on these two fronts.

● PATHLAKE GATEWAY

Gateway is a web-based platform to provide a workflow between users such as pathologist, data scientist, etc. It supports assigning images to users and effectively checking the progress of annotation on the image. Importantly, it provides the detail annotation summary completed on images, and so helps to review and plan what tasks will be required next. Currently the Gateway is going through set-up and being deployed Gateway to a new server. The team are developing new functionalities and also transfer/import new image data set for the exemplar projects.

● WASABI

WASABI is a web-based platform to make annotations on whole slide images based on HistomicsTK. It provides rich interfaces to draw annotation with rectangle and polygon to get a region of the images and with circle to get a cell of the images. With this annotation capability, it allows to collect annotation information for further data analysis and machine learning.

● DATA STORAGE

We welcome the arrival of our IBM/ESS storage system at PathLAKE. Although there are some hurdles to get through with assembling and testing due to COVID, it is a huge step forward towards the development of the central data lake.

● PROJECT MANAGEMENT

There has been much work over the past month on the direction and goals of PathLAKE. We now have many visual project management tools being updated to help the team see the end results and the ongoing success of the research and development work being done. Thanks to our amazing admin team (Chien and Hannah) for all their hard work on streamlining the admin processes.

● TANGO2

Beat the Pathologist! Our software engineers have been hard at work over the summer developing a competition for children to experience more digital pathology and learn hands on, whilst competing with others. This has been re-launched at the recent Oxford Science Festival on 17 October.



Publications

Despite the challenges Covid has presented, the PathLAKE team has been busy producing high quality publications throughout the summer. The latest list of publications is shown below and can also be found on our [website](#)

Use of artificial intelligence in diagnosis of head and neck precancerous and cancerous lesions: A systematic review, H. Mahmood, M. Shaban, B.I. Indave, A.R.Santos-Silva, N.Rajpoot, S.A. Khurrum. **Oral Oncology**, vol 110, November 2020, 104885. Available: [\[DOI\]](#)

NuClick: A deep learning framework for interactive segmentation of microscopic images, N. Alemi Koohbanani, M. Jahanifar, N.Zamina Tajadin, Nasir Rajpoot, **Medical Image Analysis**, vol 65, October 2020. Available: [\[DOI\]](#)

Diagnostic concordance and discordance in digital pathology : a systematic review and meta-analysis, Azam, Ayesha, Miligy, Islam, Kimani, Peter K., Maqbool, Heeba, Hewitt, Katherine, Rajpoot, Nasir and Snead, David. **Journal of Clinical Pathology**, 15th September 2020, Available: [\[DOI\]](#)

The International Collaboration for Cancer Classification and Research, Ian A. Cree, Iciar Indave, Jiri Zavadil, James McKay, Magali Olivier, Zisis Kozlakidis, Alexander J. Lazar, Chris Hyde, Stephen Holdenrieder, Ros Hastings, Nasir Rajpoot, Arnaud de la Fouchardiere, Brian Rous, Jean Claude Zenklusen, Nicole Normanno, Richard L. Schilsky, for IC3R participants, 20th August 2020. Available: [\[DOI\]](#)

Stitching across the Frontier for Generating Colorectal Cancer Histology Images, Sri Jay Deshpande, Fayyaz Minhas, Simon Graham, Nasir Rajpoot. **MICCAI SASHIMI Workshop**, 11th August 2020. Available: [\[DOI\]](#)

Dense Steerable Filter CNNs for Exploiting Rotational Symmetry in Histology Images, Simon Graham, David Epstein, Nasir Rajpoot. **IEEE Transactions on Medical Imaging**, 31st July 2020. Available: [\[DOI\]](#)

Digital pathology and artificial intelligence will be key to supporting clinical and academic cellular pathology through COVID-19 and future crises: the PathLAKE consortium perspective, Lisa Browning, Richard Colling, Emad Rakha, Nasir Rajpoot, Jens Rittscher, Jacqueline A James, Manual Salto-Tellez, David R J Snead, Clare Verrill. **Journal of Clinical Pathology**, 3rd July 2020. Available: [\[DOI\]](#)

Visual histological assessment of morphological features reflects the underlying molecular profile in invasive breast cancer: a morphomolecular study, Emad A Rakha, Mansour AlSaleem, Khoud A ElSharawy, Michael S Toss, Sara Raafat, Raluca Mihai, Fayyaz A Minhas, Nasir Rajpoot, Leslie W Dalton, Nigel P Mongan, **Histopathology**, 02 July 2020. Available: [\[DOI\]](#)

Cellular community detection for tissue phenotyping in colorectal cancer histology images, S. Javed, A. Mahmood, M.M. Fraz, N. Alemi Koohbanani, K. Benes, Y.W. Tsang, K. Hewitt, D.B.A. Epstein, D. Snead and N. Rajpoot, **Medical Image Analysis**, vol. 63, p. 101696, July 2020. Available: [\[DOI\]](#)

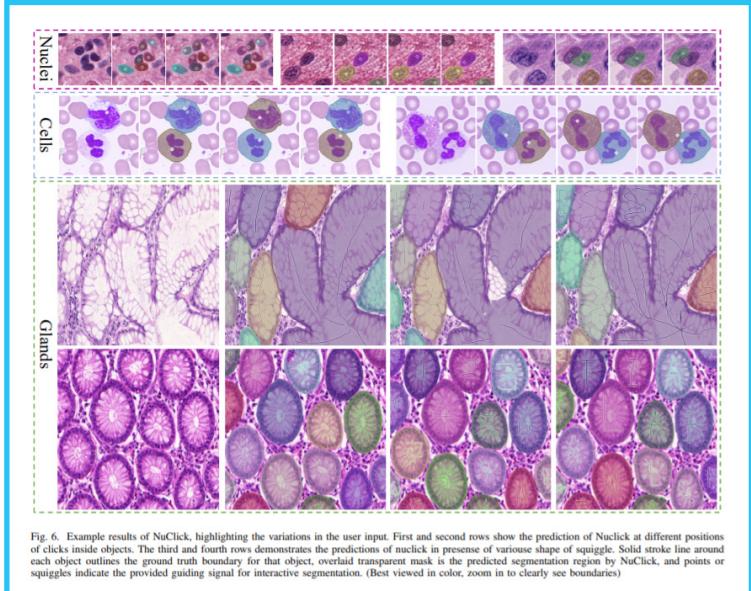
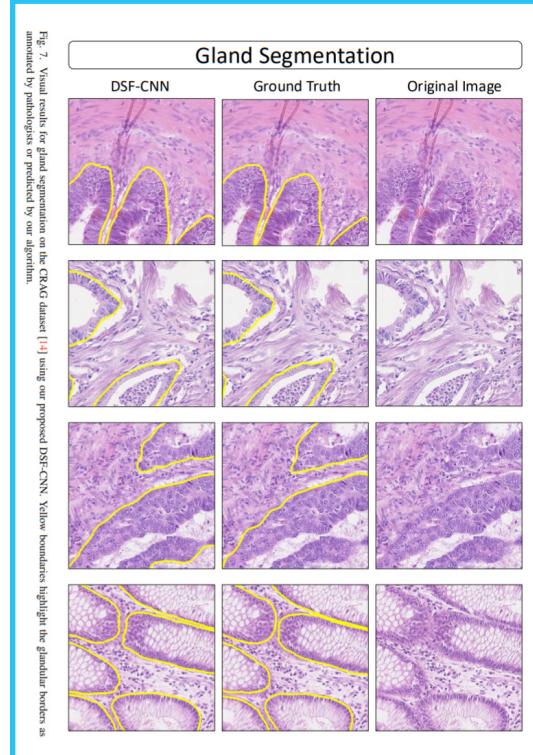
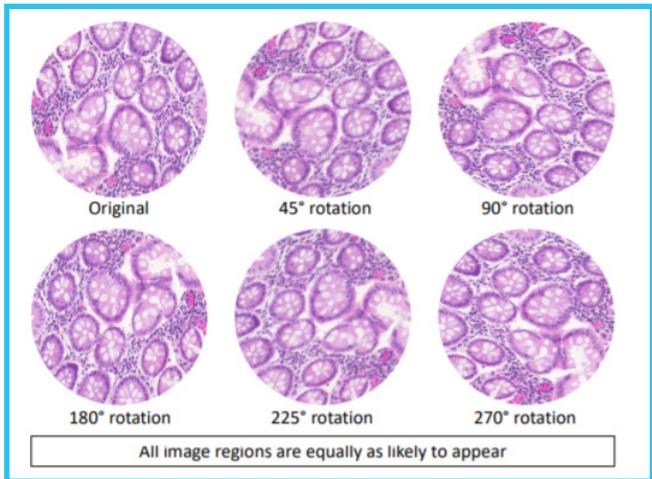


Fig. 6. Example results of NuClick, highlighting the variations in the user input. First and second rows show the prediction of NuClick at different positions of clicks inside objects. The third and fourth rows demonstrates the predictions of nucluck in presence of various shape of squiggle. Solid stroke line around each object outlines the ground truth boundary for that object, overlaid transparent mask is the predicted segmentation region by NuClick, and points or squiggles indicate the provided guiding signal for interactive segmentation. (Best viewed in color, zoom in to clearly see boundaries)



Congratulations!

- Congratulations to our Data Scientist Simon Graham on the successful completion of his PhD thesis titled "Localisation and Symmetry in Computational Pathology" in June 2020. Simon continues with PathLAKE as a Data Scientist.
- Congratulations to our part-time Data Scientist Muhammad Shaban on the successful completion of his PhD thesis titled "Spatial Context in Computational Pathology" in September 2020. We wish Shaban all the very best as he embarks on his new role as a postdoctoral research fellow in Mahmood Lab at the Harvard Medical School.
- Congratulations to our Research Fellow Wenqi Lu for the successful completion of her PhD thesis at the University of Birmingham.



Impact of Covid-19

Due to the current pandemic across the world, this summer has been challenging in many ways for PathLAKE and for many other research projects. However, even during these difficult circumstances we have continued to achieve excellence and collaborate virtually and are meeting the project milestones. Following guidance from the university and the department, we are looking for more safe ways to collaborate in the office as the University re-opens and find creative ways of working together.

Well-being

COFFEE MORNINGS AND WELL-BEING

Due to the current circumstances, we are placing more focus on the well-being of research staff, especially at a time when we seem to be moving into a more 'virtual world'.

We regularly meet and continue our Swedish style 'Fika coffee mornings' over zoom every week, which strictly encourages conversation of non-work related items!



COMPUTER SCIENCE I AM IN THE BUILDING

The university is also developing ways of becoming more aware of who may be in the office at the same time as others. See Maria Ovens for more information on how to sign and join up.

Don't forget to take your 'Covid-19 induction' when you are planning to go to the Department of Computer Science! Extra:

It can be hard working from home when we are so used to an office routine. Make sure to keep awareness of 'well-being' and providing yourself with breaks and exercise routines.

Take a look at this [website](#) for an example of doing this.



A virtual day
can be tough so
stay aware and
take care of your
mind and health!

Recruitment

It has been a busy summer for PathLAKE recruitment!

We welcome on board:

- Mohsin Bilal
Senior Research Fellow
(Data Scientist)
- Chien-Hui Liao
Senior Project Manager
- Mostafa Jahanifar
Research Fellow
- George Hadjigeorgiou
PathLAKE temporary software engineer



However we are also sorry to lose:

- Muhammad Shaban
We thank Shaban for all his hard work at PathLAKE and wish him the best at Harvard
- Joshua Hankins: PathLAKE temporary software engineer
- Daniel Smith: PathLAKE temporary software engineer
- Valentin Stoykov: PathLAKE temporary software engineer

Thank you all for your time and hard work at PathLAKE, we wish you all the best for the future!

Upcoming news and Events

Check our [website](#). Keep an eye out on our PathLAKE website for more information and also browse in more detail our team, twitter account, projects and vision for the future.

Virtual masterclasses in February/March 2021

Masterclasses at PathLAKE were previously delivered by world leading experts working in the area of computational pathology and also involved internal/external guests who together shared their experiences, insights, guidance and materials during the masterclasses and discussed issues or topics of a relevant and practical nature. We are looking to create a similar format virtually during 2021, exact dates yet to be confirmed. Please remember to check our PathLAKE website for any updates.

Also remember '**Beat the Pathologist!**' competition for children, launched in October Science Week. Check out the [website](#) for more details.

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Upcoming

Our YouTube channel, with project related videos is work in progress and should be available in the near future. Keep an eye out on our PathLAKE website for further information, and also to browse in more detail our team, projects and vision for the future.

Also follow our twitter account and [website](#) for up to date achievements, success and news from the PathLAKE team!

