

Intelligence Artificielle en ACP

PROVINCIAL
MEDICAL & SURGICAL JOURNAL.

ISSUED BY DR. GREEN AND DR. STRATHERS.
No. 1, Vol. 1 LONDON, ENGLAND, OCTOBER 8, 1901.

CONTENTS

1. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1
2. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1
3. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1
4. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1
5. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1
6. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1
7. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1
8. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1
9. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1
10. Report on the results of the examination of the specimens of the lungs of a patient who died of pneumonia.	1

HISTORICAL NOTES.
In the examination of the lungs of a patient who died of pneumonia, the following facts were observed:—
1. The lungs were found to be enlarged and consolidated.
2. The consolidation was of a lobular character.
3. The consolidation was of a purulent character.
4. The consolidation was of a fibrinous character.
5. The consolidation was of a caseous character.
6. The consolidation was of a calcareous character.
7. The consolidation was of a tuberculous character.
8. The consolidation was of a carcinomatous character.
9. The consolidation was of a sarcomatous character.
10. The consolidation was of a melanomatous character.

Analyse d'Articles Récents



Prof. Nicolas Loménie

Professeur Intelligence Artificielle et Vision par Ordinateur,

Objectifs :

Nous allons présenter rapidement 4 articles récents et assez généraliste où l'aspect médical est prépondérant.

Vous lirez ensuite ces articles qui sont disponibles avec quelques annotations de notre part pour souligner les points saillants pour ce niveau d'analyse.

Vous répondrez aux questions posées après chaque lecture d'article. Une session d'échange en ligne est prévue pour échanger sur vos réponses.



January 2021 <https://meridian.allenpress.com/aplm/>

A Deep Learning Convolutional Neural Network Can Differentiate Between *Helicobacter Pylori* Gastritis and Autoimmune Gastritis With Results Comparable to Gastrointestinal Pathologists

Michael M. Franklin, DO; Fred A. Schultz, MA; Marissa A. Tafoya, MD; Audra A. Kerwin, MD; Cory J. Broehm, MD; Edgar G. Fischer, MD, PhD; Rama R. Gullapalli, MD, PhD; Douglas P. Clark, MD; Joshua A. Hanson, MD; David R. Martin, MD

• **Context.**—Pathology studies using convolutional neural networks (CNNs) have focused on neoplasms, while studies in inflammatory pathology are rare. We previously demonstrated a CNN differentiates reactive gastropathy, *Helicobacter pylori* gastritis (HPG), and normal gastric mucosa.

• **Objective.**—To determine whether a CNN can differentiate the following 2 gastric inflammatory patterns: autoimmune gastritis (AG) and HPG.

• **Design.**—Gold standard diagnoses were blindly established by 2 gastrointestinal (GI) pathologists. One hundred eighty-seven cases were scanned for analysis by HALO-AI. All levels and tissue fragments per slide were included for analysis. The cases were randomized, 112 (60%; 60 HPG, 52 AG) in the training set and 75 (40%; 40 HPG, 35 AG) in the test set. A HALO-AI correct area distribution (AD) cutoff of 50% or more was required to credit the CNN with the correct diagnosis. The test set was blindly

reviewed by pathologists with different levels of GI pathology expertise as follows: 2 GI pathologists, 2 general surgical pathologists, and 2 residents. Each pathologist rendered their preferred diagnosis, HPG or AG.

• **Results.**—At the HALO-AI AD percentage cutoff of 50% or more, the CNN results were 100% concordant with the gold standard diagnoses. On average, autoimmune gastritis cases had 84.7% HALO-AI autoimmune gastritis AD and HP cases had 87.3% HALO-AI HP AD. The GI pathologists, general anatomic pathologists, and residents were on average, 100%, 86%, and 57% concordant with the gold standard diagnoses, respectively.

• **Conclusions.**—A CNN can distinguish between cases of HPG and autoimmune gastritis with accuracy equal to GI pathologists.

(*Arch Pathol Lab Med.* doi: 10.5858/arpa.2020-0520-OA)

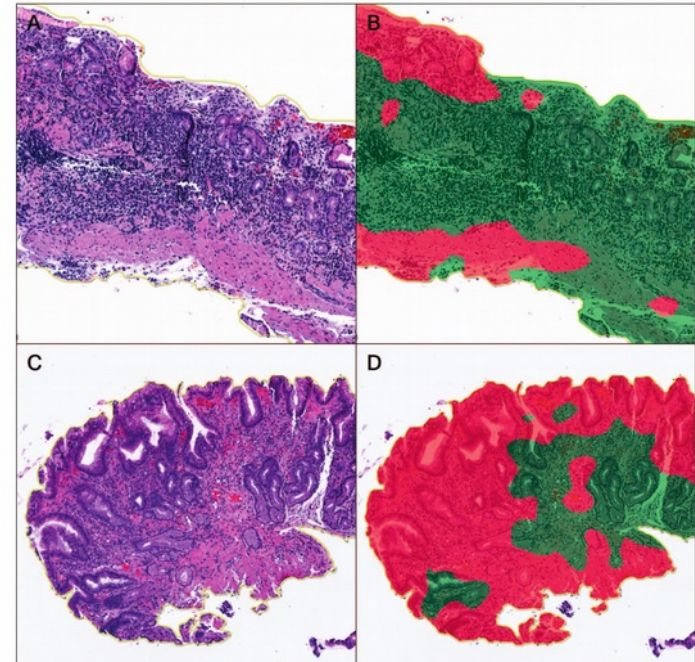


Figure 3. Hematoxylin-eosin stain, $\times 4$ on digital slide viewer. (A) Autoimmune gastritis demonstrating lymphoplasmacytic inflammation spread evenly throughout the lamina propria in atrophic/antralized gastric body mucosa. (B) The paired HALO-AI green area distribution (AD) shows a majority call of autoimmune gastritis, and thus the convolutional neural network (CNN) is credited for a correct diagnosis. (C) A case of *Helicobacter pylori* gastritis shows the classic top-heavy chronic inflammatory infiltrate. (D) HALO-AI correctly assigns a red *H. pylori* AD to the majority of this tissue fragment and is credited with a correct diagnosis.

1

A Deep Learning Convolutional Neural Network Can Differentiate Between *Helicobacter Pylori* Gastritis and Autoimmune Gastritis With Results Comparable to Gastrointestinal Pathologists

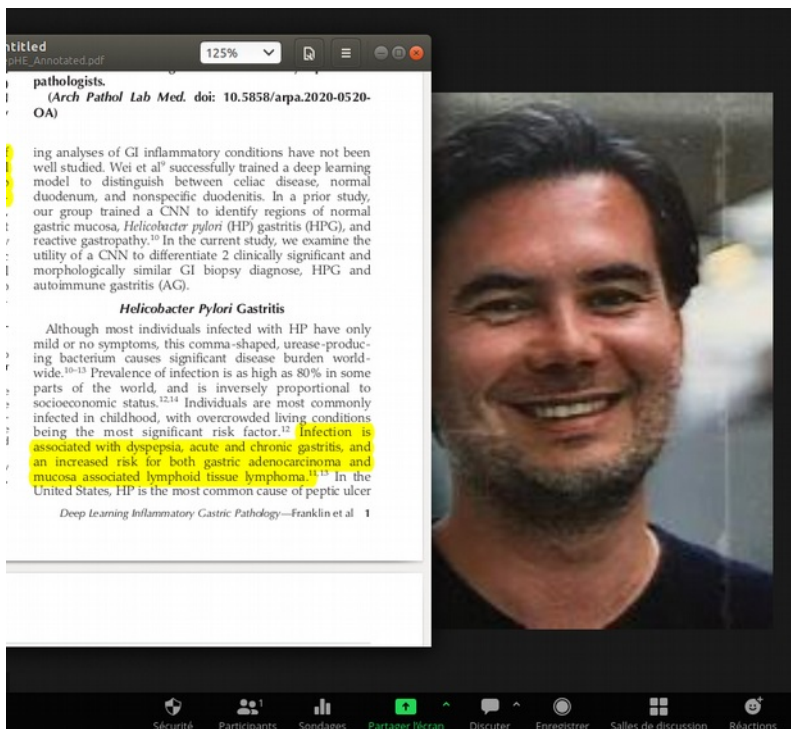
Michael M. Franklin, DO; Fred A. Schultz, MA; Marissa A. Tafoya, MD; Audra A. Kerwin, MD; Cory J. Broehm, MD; Edgar G. Fischer, MD, PhD; Rama R. Gullapalli, MD, PhD; Douglas P. Clark, MD; Joshua A. Hanson, MD; David R. Martin, MD

Dans cet article, on trouvera un cas d'école pour l'analyse de lames H&E via l'IA avec :

- ✓ Une introduction générale sur l'IA et les CNN pour la reconnaissance de motifs visuels dans les images histopathologiques;
- ✓ Une application intéressante sur le diagnostic gastrique;
- ✓ Une comparaison argumentée sur la performance comparée IA vs. Pathologistes.

A Deep Learning Convolutional Neural Network Can Differentiate Between *Helicobacter Pylori* Gastritis and Autoimmune Gastritis With Results Comparable to Gastrointestinal Pathologists

Michael M. Franklin, DO; Fred A. Schultz, MA; Marissa A. Tafoya, MD; Audra A. Kerwin, MD; Cory J. Broehm, MD; Edgar G. Fischer, MD, PhD; Rama R. Gullapalli, MD, PhD; Douglas P. Clark, MD; Joshua A. Hanson, MD; David R. Martin, MD

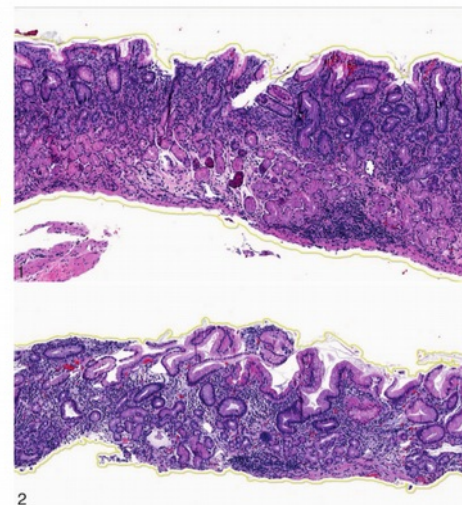


The screenshot shows a video player interface. On the left, a PDF document titled "pathologists." is displayed, containing text about GI inflammatory conditions and a section on *Helicobacter Pylori* Gastritis. On the right, a portrait of Michael M. Franklin is shown. The video player controls at the bottom include icons for security, participants, sondages, Partagez librement, Discuter, Enregistrer, Salles de discussion, and Réactions.

Visualisez la première vidéo

Figure 1. Hematoxylin-eosin stain, $\times 5.5$ on digital slide viewer. This antral biopsy from a case of *Helicobacter pylori* gastritis demonstrates the classic superficial band-like chronic inflammatory infiltrate seen in the majority of cases.

Figure 2. Hematoxylin-eosin stain, $\times 5.5$ on digital slide viewer. This gastric body biopsy in a case of autoimmune gastritis shows complete atrophy/loss of the normal oxyntic mucosa. The parietal cells and chief cells are gone and are replaced by mucous-neck cells (antralization). The chronic inflammation is spread evenly throughout the mucosa as opposed to the typical top-heavy distribution often seen in *Helicobacter pylori* gastritis.



disease, leading to an annual health care cost of an estimated 6 billion dollars.¹⁷

HP typically resides in the mucin layer adjacent to the foveolar epithelium and induces a band-like, superficial lymphoplasmacytic infiltrate in the gastric mucosa, which is usually antral predominant (Figure 1).^{11,13,15} Acute inflammation and lymphoid aggregates with germinal centers are also hallmarks of this infection, along with morphologic identification of the organisms in biopsy specimens.^{13,15} In patients with chronic proton pump inhibitor use, the body of the stomach can also be heavily colonized and

clinically symptomatic, including anemia or gastrointestinal (GI) complaints.^{17,18} Diagnosis can be aided with serologic findings of hypergastrinemia, and the presence of anti-intrinsic factor and/or antiparietal cell antibodies. However, the diagnosis ultimately is confirmed on biopsy findings.

The histopathologic changes associated with AG can be broken into a spectrum of early- and late-histologic phases in the gastric body. Early lymphoplasmacytic infiltration can be subtle and may be the only visible change in early disease. Unlike HPG, which creates a top-heavy infiltrate, the AG inflammatory pattern is full thickness within the gastric mucosa.^{16,18}

1

A Deep Learning Convolutional Neural Network Can Differentiate Between *Helicobacter Pylori* Gastritis and Autoimmune Gastritis With Results Comparable to Gastrointestinal Pathologists

Michael M. Franklin, DO; Fred A. Schultz, MA; Marissa A. Tafoya, MD; Audra A. Kerwin, MD; Cory J. Broehm, MD; Edgar G. Fischer, MD, PhD; Rama R. Gullapalli, MD, PhD; Douglas P. Clark, MD; Joshua A. Hanson, MD; David R. Martin, MD

Questions / Activités :

- ✓ Donnez votre définition de l'IA en étant le plus pointu possible;
- ✓ Caractérisez le cas clinique proposé et le challenge de diagnostic associé;
- ✓ Explicitez l'apport potentiel de l'IA en pratique clinique selon les auteurs de l'article puis selon votre point de vue;
- ✓ Appréciez les performances de l'IA vs. pathologistes telles que décrites par cette recherche et concluez sur votre pratique dans 10 ans.

History of The BMJ

The BMJ is one of the world's oldest general medical journals. It published its first weekly edition on 3 October 1840 as the *Provincial Medical and Surgical Journal* before uniting with the *London Journal of Medicine* and publishing from January 1853 as the *Associated Medical Journal*. Four years later in January 1857, this merged journal became the *British Medical Journal*. The title was shortened to *BMJ* in 1988, and then changed to *The BMJ* in 2014.

March 2020 <https://www.bmj.com/> / Intended for healthcare professionals

Artificial intelligence versus clinicians: systematic review of design, reporting standards, and claims of deep learning studies

Myura Nagendran,¹ Yang Chen,² Christopher A Lovejoy,³ Anthony C Gordon,^{1,4} Matthieu Komorowski,⁵ Hugh Harvey,⁶ Eric J Topol,⁷ John P A Ioannidis,⁸ Gary S Collins,^{9,10} Mahiben Maruthappu³

ABSTRACT

OBJECTIVE

To systematically examine the design, reporting standards, risk of bias, and claims of studies comparing the performance of diagnostic deep learning algorithms for medical imaging with that of expert clinicians.

DESIGN

Systematic review.

DATA SOURCES

REVIEW METHODS

Adherence to reporting standards was assessed by using CONSORT (consolidated standards of reporting trials) for randomised studies and TRIPOD (transparent reporting of a multivariable prediction model for individual prognosis or diagnosis) for non-randomised studies. Risk of bias was assessed by using the Cochrane risk of bias tool for randomised studies and PROBAST (prediction model risk of bias assessment tool) for non-randomised studies.



History of The BMJ

The BMJ is one of the world's oldest general medical journals. It published its first weekly edition on 3 October 1840 as the *Provincial Medical and Surgical Journal* before uniting with the *London Journal of Medicine* and publishing from January 1853 as the *Associated Medical Journal*. Four years later in January 1857, this merged journal became the *British Medical Journal*. The title was shortened to *BMJ* in 1988, and then changed to *The BMJ* in 2014.

Dans cet article, on trouvera une étude intéressante à destination de professionnels de la santé (cliniciens, chercheurs, start-up) avec :

- ✓ Une introduction générale sur les CNN pour la reconnaissance de formes dans les images médicales en général (radiologiques et histopathologiques).
- ✓ Une vision à 360 degrés de ce qui se fait à l'heure actuelle et un constat quantitatif sur les spécialités concernées (Table 2.)
- ✓ Des recommandations intéressantes pour vos possibles prochains projets de recherche collaboratifs;

History of The BMJ

The BMJ is one of the world's oldest general medical journals. It published its first weekly edition on 3 October 1840 as the *Provincial Medical and Surgical Journal* before uniting with the *London Journal of Medicine* and publishing from January 1853 as the *Associated Medical Journal*. Four years later in January 1857, this merged journal became the *British Medical Journal*. The title was shortened to *BMJ* in 1988, and then changed to *The BMJ* in 2014.

Artificial intelligence versus clinicians: systematic review of design, reporting standards, and claims of deep learning studies

Myra Nagendran,¹ Yang Chen,² Christopher A Lovejoy,³ Anthony C Gordon,^{1,4} Matthieu Komorowski,⁵ Hugh Harvey,⁶ Eric J Topol,⁷ John P A Ioannidis,⁸ Gary S Collins,^{9,10} Mahiben Maruthappu³

ABSTRACT OBJECTIVE

To systematically examine the design, reporting standards, risk of bias, and claims of studies comparing the performance of diagnostic deep learning algorithms for medical imaging with that of expert clinicians.

DESIGN

Systematic review.

DATA SOURCES

Medline, Embase, Cochrane Central Register of Controlled Trials, and the World Health Organization trial registry from 2010 to June 2019.

ELIGIBILITY CRITERIA FOR SELECTING STUDIES

Randomised trial registrations and non-randomised studies comparing the performance of a deep learning algorithm in medical imaging with a contemporary group of one or more expert clinicians. Medical imaging has seen a growing interest in deep learning research. The main distinguishing feature of convolutional neural networks (CNNs) in deep learning is that when CNNs are fed with raw data, they develop their own representations needed for pattern recognition. The algorithm learns for itself the features of an image that are important for classification rather than being told by humans which features to use. The selected studies aimed

REVIEW METHODS

Adherence to reporting standards was assessed by using CONSORT (consolidated standards of reporting trials) for randomised studies and TRIPOD (transparent reporting of a multivariable prediction model for individual prognosis or diagnosis) for non-randomised studies. Risk of bias was assessed by using the Cochrane risk of bias tool for randomised studies and PROBAST (prediction model risk of bias assessment tool) for non-randomised studies.

RESULTS

Only 10 records were found for deep learning randomised clinical trials, two of which have been published (with low risk of bias, except for lack of blinding, and high adherence to reporting standards) and eight are ongoing. Of 81 non-randomised clinical trials identified, only nine were prospective and just six were tested in a real world clinical setting. The median number of experts in the comparator group was only four (interquartile range 2-9).

Full access to all datasets and code was severely limited (unavailable in 95% and 93% of studies, respectively). The overall risk of bias was high in 58 of 81 studies and adherence to reporting standards was suboptimal (<50% adherence for 12 of 29 TRIPOD items). 61 of 81 studies stated in their abstract that performance of artificial intelligence was at least

Ecoutez le podcast numéro 2

The image shows a screenshot of a PDF document titled "Deep Learning Inflammatory Gastric Pathology—Franklin et al." The document is displayed in a viewer window with a zoom level of 125%. The text on the left side of the page discusses the utility of a CNN to differentiate 2 clinically significant and morphologically similar GI biopsy diagnoses, HPG and autoimmune gastritis (AG). It mentions that although most individuals infected with HP have mild or no symptoms, this comma-shaped, urease-producing bacterium causes significant disease burden worldwide. The prevalence of infection is as high as 80% in some parts of the world, and is inversely proportional to socioeconomic status. Individuals are most commonly infected in childhood, with overcrowded living conditions being the most significant risk factor. The text highlights that infection is associated with dyspepsia, acute and chronic gastritis, and an increased risk for both gastric adenocarcinoma and mucosa associated lymphoid tissue lymphoma. In the United States, HP is the most common cause of peptic ulcer.

On the right side of the screenshot, there is a portrait of a man with dark hair and a beard, smiling. The bottom of the screenshot shows a navigation bar with icons for "Sécurité", "Participants", "Sondages", "Partager l'écran", "Discuter", "Favoriser", "Saller de discussion", and "Réactions".

History of The BMJ

The BMJ is one of the world's oldest general medical journals. It published its first weekly edition on 3 October 1840 as the *Provincial Medical and Surgical Journal* before uniting with the *London Journal of Medicine* and publishing from January 1853 as the *Associated Medical Journal*. Four years later in January 1857, this merged journal became the *British Medical Journal*. The title was shortened to *BMJ* in 1988, and then changed to *The BMJ* in 2014.

Questions / Activités :

- ✓ Quelle est la proportion en termes d'organes / maladies ?
- ✓ Quelle recommandation essentielle retenez-vous de cette étude systématique ?
- ✓ Quelle est la proportion d'études en Histopathologie vs. Total en 2020 ?
- ✓ Avez-vous une idée du nombre de procédé lié à l'IA accepté en histopathologie par la FDA notamment versus en radiologie en 2023 ?

June 2021 <https://arxiv.org/abs/2102.01678>

Learning domain-agnostic visual representation for computational pathology using medically-irrelevant style transfer augmentation

Rikiya Yamashita, Jin Long, Snikitha Banda, Jeanne Shen, Daniel L. Rubin
 Stanford University
 {rikiya, jinlong, jeannes, rubin}@stanford.edu

ABSTRACT

Suboptimal generalization of machine learning models on unseen data is a key challenge which hampers the clinical applicability of such models to medical imaging. Although various methods such as domain adaptation and domain generalization have evolved to combat this challenge, learning robust and generalizable representations is core to medical image understanding, and continues to be a problem. Here, we propose **STRAP** (Style **T**Ransfer Augmentation for histo**P**athology), a form of data augmentation based on random style transfer from non-medical style source such as artistic paintings, for learning domain-agnostic visual representations in computational pathology. Style transfer replaces the low-level texture content of an image with the uninformative style of randomly selected style source image, while preserving the original high-level semantic content. This improves robustness to domain shift and can be used as a simple yet powerful tool for learning domain-agnostic representations. We demonstrate that STRAP leads to state-of-the-art performance, particularly in the presence of domain shifts, on two particular classification tasks in computational pathology.

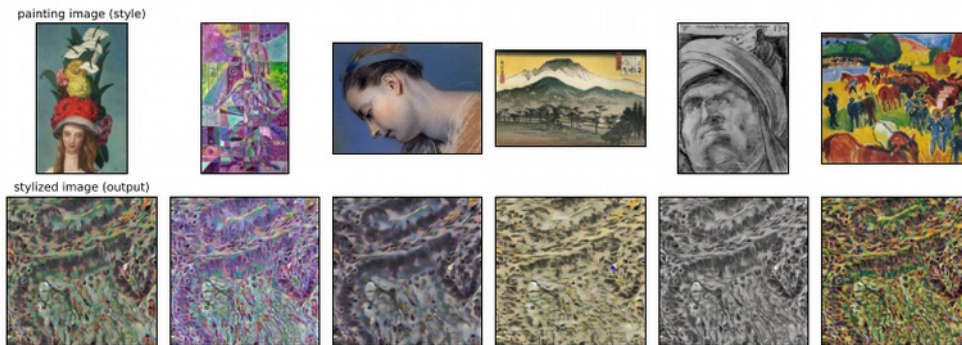
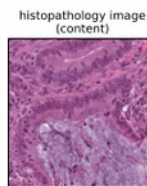


Figure 2: Style transfer with artistic paintings as a style source (stylization coefficient of 1.0) applied to a histopathology image (content on the left). Overall geometry is preserved, but the style, including texture, color, and contrast, is replaced with an uninformative style of a randomly selected artistic painting.

Des mêmes auteurs : *Deep learning model for the prediction of microsatellite instability in colorectal cancer: a diagnostic study / The Lancet Oncology / <https://linkinghub.elsevier.com/retrieve/pii/S1470204520305350>*

Learning domain-agnostic visual representation for computational pathology using medically-irrelevant style transfer augmentation

Rikiya Yamashita, Jin Long, Snikitha Banda, Jeanne Shen, Daniel L. Rubin
Stanford University
{rikiya, jinlong, jeannes, rubin}@stanford.edu

- Dans cet article, on trouvera :
 - ✓ Une étude intéressante sur l'aspect vision et modélisation de la lecture de lame par le médecin ;
 - ✓ Des détails plus liés au traitement du signal comme l'analyse par fréquences, par texture, par forme ;
 - ✓ Une approche originale et amusante par transfert de style sur des images de peintures.

Learning domain-agnostic visual representation for computational pathology using medically-irrelevant style transfer augmentation

Rikiya Yamashita, Jin Long, Snikitha Banda, Jeanne Shen, Daniel L. Rubin
Stanford University
{rikiya, jinlong, jeannes, rubin}@stanford.edu

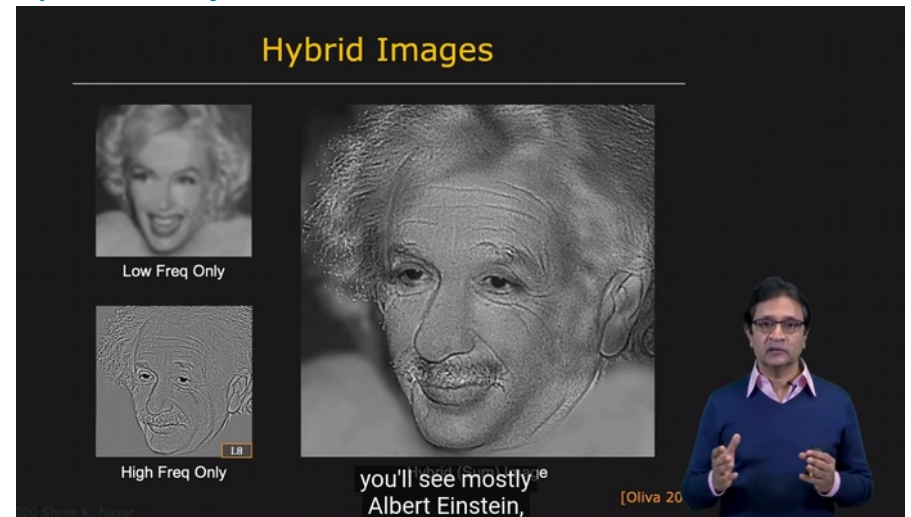
Analyse en fréquences du signal image

https://www.youtube.com/watch?v=Wka_XhcZAcQ



Passez les 2' du début si nécessaire

<https://www.youtube.com/watch?v=OOu5KP3Gvx0>



Allez aux 2' du final si nécessaire

Learning domain-agnostic visual representation for computational pathology using medically-irrelevant style transfer augmentation

Rikiya Yamashita, Jin Long, Snikitha Banda, Jeanne Shen, Daniel L. Rubin
Stanford University
{rikiya, jinlong, jeannes, rubin}@stanford.edu

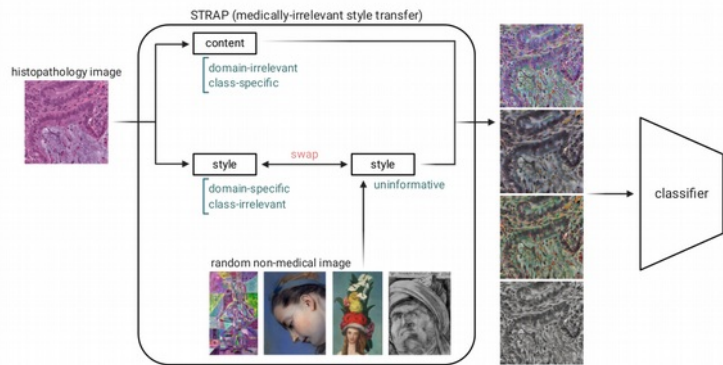


Figure 1: Overview of STRAP

unseen target data from multiple domains. A solution to domain-agnostic learning/single-domain generalization should learn domain-invariant and class-specific visual representations, as humans do.

Geirhos *et al.* [4] showed that 1) convolutional neural networks (CNNs) trained on the ImageNet dataset are biased towards texture, whereas humans are more reliant on global shape for distinguishing classes, 2) CNNs tend not to cope well with domain shifts, *i.e.*, the change in image statistics from those on which the networks have been trained to those which the networks have never seen before, and 3) increasing shape bias by training on a stylized version of the ImageNet generated using style transfer improves accuracy, robustness, and generalizability.

Neural style transfer [5] refers to a CNN-based image transformation algorithm that manipulates the low-level texture representation of an image, *i.e.*, style, while preserving its semantic content. The original method by Gatys *et al.* uses Gram matrices of the activations from different layers of a CNN to represent the style of an image. Then it uses an

Ecoutez le
podcast numéro 3

pathologists.
(Arch Pathol Lab Med. doi: 10.5858/arpa.2020-0520-OA)

ing analyses of GI inflammatory conditions have not been well studied. Wei *et al.* successfully trained a deep learning model to distinguish between celiac disease, normal duodenum, and nonspecific duodenitis. In a prior study, our group trained a CNN to identify regions of normal gastric mucosa, *Helicobacter pylori* (HP) gastritis (HPG), and reactive gastropathy.¹⁰ In the current study, we examine the utility of a CNN to differentiate 2 clinically significant and morphologically similar GI biopsy diagnoses, HPG and autoimmune gastritis (AG).

Helicobacter Pylori Gastritis

Although most individuals infected with HP have only mild or no symptoms, this comma-shaped, urease-producing bacterium causes significant disease burden worldwide.¹⁰⁻¹³ Prevalence of infection is as high as 80% in some parts of the world, and is inversely proportional to socioeconomic status.^{12,14} Individuals are most commonly infected in childhood, with overcrowded living conditions being the most significant risk factor.¹² Infection is associated with dyspepsia, acute and chronic gastritis, and an increased risk for both gastric adenocarcinoma and mucosa associated lymphoid tissue lymphoma.^{11,15} In the United States, HP is the most common cause of peptic ulcer

Deep Learning Inflammatory Gastric Pathology—Franklin *et al.* 1

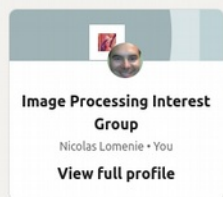
Learning domain-agnostic visual representation for computational pathology using medically-irrelevant style transfer augmentation

Rikiya Yamashita, Jin Long, Snikitha Banda, Jeanne Shen, Daniel L. Rubin
Stanford University
{rikiya, jinlong, jeannes, rubin}@stanford.edu

- Questions / Activités :
 - ✓ Quelle est votre opinion concernant l'hypothèse formulée par les auteurs à savoir que vous seriez biaisé.e.s vers les informations de forme plutôt que de texture ?
 - ✓ Pourriez-vous définir la technique dite de «*Data Augmentation* » et faire le lien sur la méthodologie de ce travail de recherche ?
 - ✓ Définissez la notion de «*Domaine* » tel que décrite dans l'article et explicitez la notion de «*Domain transfert* ».
 - ✓ Faites un résumé en cinq lignes de l'idée sous-jacente de l'article sur le transfert de style en lien avec les points formulés précédemment (*Domain transfert*, contenu informatif de l'image (Forme vs. Texture), *Data augmentation* et généralisation). Et la couleur dans tous cela ?

Learning domain-agnostic visual representation for computational pathology using medically-irrelevant style transfer augmentation

Rikiya Yamashita, Jin Long, Snikitha Banda, Jeanne Shen, Daniel L. Rubin
Stanford University
{rikiya, jinlong, jeannes, rubin}@stanford.edu



et voilà :-)

[See translation](#)



SAM: Segment Anything Model.
A Foundation model for image segmentation.
From FAIR.

Demo: <https://lnkd.in/efqj8EFM>
Blog: <https://lnkd.in/eKu4GHR>
Paper: <https://lnkd.in/ejSzF7RD>
Code: https://lnkd.in/eDU_Qgg2
Dataset: SA-1B, 11 million image, 1 billion masks <https://lnkd.in/eEXuX7Kv>



👍 3

1 comment

Avril 2023

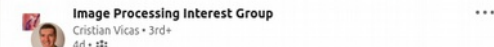
https://www.linkedin.com/feed/update/urn:li:activity:7049612384780324864?utm_source=share&utm_medium=member_desktop



Image Processing Interest Group

Cristian Vicas • 3rd+

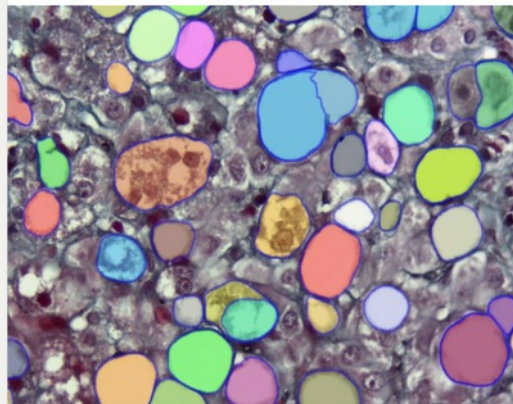
[View full profile](#)



Tried out **Meta AI** new segmentation demo. Impressed, esp from their interactive selection tool.

I didn't get the "best" segmented histological image out of the box, but it was a pretty decent estimation!

[link in the comments]
[#medicalai](#) [#computervision](#) [#segmentation](#)



Google AI Healthcare

Mountain View, CA, USA

March 2018 <https://arxiv.org/pdf/1812.00825.pdf>

<https://health.google/health-research/>

Microscope 2.0: An Augmented Reality Microscope with Real-time Artificial Intelligence Integration

Po-Hsuan (Cameron) Chen*, Krishna Gadepalli*, Robert MacDonald*, Yun Liu, Kunal Nagpal, Timo Kohlberger, Jeffrey Dean, Greg S. Corrado, Jason D. Hipp, Martin C. Stumpe

Google AI Healthcare, Mountain View, CA, USA.

*These authors contributed equally to this work.

The brightfield microscope is instrumental in the visual examination of both biological and physical samples at sub-millimeter scales. One key clinical application has been in cancer histopathology, where the microscopic assessment of the tissue samples is used for the diagnosis and staging of cancer and thus guides clinical therapy¹. However, the interpretation of these samples is inherently subjective, resulting in significant diagnostic variability^{2,3}. Moreover, in many regions of the world, access to pathologists is severely limited due to lack of trained personnel⁴. In this regard, Artificial Intelligence (AI) based tools promise to improve the access and quality of healthcare⁵⁻⁷. However, despite significant advances in AI research, integration of these tools into real-world cancer diagnosis workflows remains challenging because of the costs of image digitization and difficulties in deploying AI solutions^{8,9}. Here we propose a cost-effective solution to the integration of AI: the Augmented Reality Microscope (ARM). The ARM overlays AI-based information onto the current view of the sample through the optical pathway in real-time, enabling seamless integration of AI into the regular microscopy workflow. We demonstrate the utility of ARM in the detection of lymph node metastases in breast cancer and the identification of prostate cancer with a latency that supports real-time workflows. We anticipate that ARM will remove barriers towards the use of AI in microscopic analysis and thus improve the accuracy and efficiency of cancer diagnosis. This approach is applicable to other microscopy tasks and AI algorithms in the life sciences¹⁰ and beyond^{11,12}.

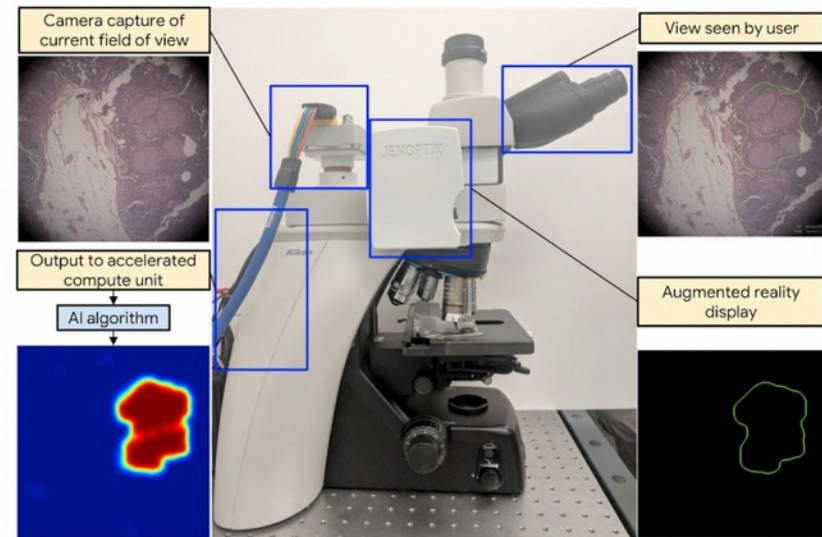


Figure 1 | Hardware components of the Augmented Reality Microscope (ARM) system enable real-time capture of the field of view and display of information in the eyepiece of the microscope. The images of the sample are continuously captured. Next, a deep learning algorithm processes each image to produce an inference output (such as a heatmap) with an accelerated compute unit. Finally, the inference output is post-processed to display the most pertinent information without obscuring the original image. For example, outlines of various colors can be used to aid detection and diagnosis tasks, and text such as size measurements can be displayed as well. Technical details can be found in Methods and Extended Data Figure 1.

Microscope 2.0: An Augmented Reality Microscope with Real-time Artificial Intelligence Integration

Po-Hsuan (Cameron) Chen*, Krishna Gadepalli*, Robert MacDonald*, Yun Liu, Kunal Nagpal,
Timo Kohlberger, Jeffrey Dean, Greg S. Corrado, Jason D. Hipp, Martin C. Stumpe

Dans cet article, on trouvera :

- ✓ Une vision d'un GAFa sur la microscopie du futur ;
- ✓ Des détails techniques instructifs sur la virtualisation d'un microscope ou du moins une version hybride.

Microscope 2.0: An Augmented Reality Microscope with Real-time Artificial Intelligence Integration

Po-Hsuan (Cameron) Chen*, Krishna Gadepalli*, Robert MacDonald*, Yun Liu, Kunal Nagpal, Timo Kohlberger, Jeffrey Dean, Greg S. Corrado, Jason D. Hipp, Martin C. Stumpe

Figures

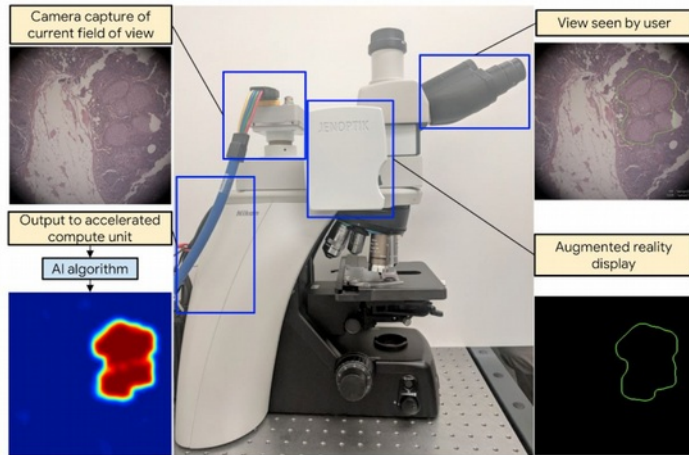


Figure 1 | Hardware components of the Augmented Reality Microscope (ARM) system enable real-time capture of the field of view and display of information in the eyepiece of the microscope. The images of the sample are continuously captured. Next, a deep learning algorithm processes each image to produce an inference output (such as a heatmap) with an accelerated compute unit. Finally, the inference output is post-processed to display the most pertinent information without obscuring the original image. For example, outlines of various colors can be used to aid detection and diagnosis tasks, and text such as size measurements can be displayed as well. Technical details can be found in Methods and Extended Data Figure 1.

Visualisez la vidéo numéro 4

pathologists.
(Arch Pathol Lab Med. doi: 10.5858/arpa.2020-0520-OA)

ing analyses of GI inflammatory conditions have not been well studied. Wei et al¹ successfully trained a deep learning model to distinguish between celiac disease, normal duodenum, and nonspecific duodenitis. In a prior study, our group trained a CNN to identify regions of normal gastric mucosa, *Helicobacter pylori* (HP) gastritis (HPG), and reactive gastropathy.¹⁰ In the current study, we examine the utility of a CNN to differentiate 2 clinically significant and morphologically similar GI biopsy diagnoses, HPG and autoimmune gastritis (AG).

Helicobacter Pylori Gastritis

Although most individuals infected with HP have only mild or no symptoms, this comma-shaped, urease-producing bacterium causes significant disease burden worldwide.¹⁰⁻¹³ Prevalence of infection is as high as 80% in some parts of the world, and is inversely proportional to socioeconomic status.^{12,14} Individuals are most commonly infected in childhood, with overcrowded living conditions being the most significant risk factor.¹² Infection is associated with dyspepsia, acute and chronic gastritis, and an increased risk for both gastric adenocarcinoma and mucosa associated lymphoid tissue lymphoma.^{11,15} In the United States, HP is the most common cause of peptic ulcer

Deep Learning Inflammatory Gastric Pathology—Franklin et al 1

Microscope 2.0: An Augmented Reality Microscope with Real-time Artificial Intelligence Integration

Po-Hsuan (Cameron) Chen*, Krishna Gadepalli*, Robert MacDonald*, Yun Liu, Kunal Nagpal,
Timo Kohlberger, Jeffrey Dean, Greg S. Corrado, Jason D. Hipp, Martin C. Stumpe

Questions / Activités :

- ✓ Quel serait le microscope 2.0 de vos rêves ?
- ✓ Quelle information supplémentaire aimeriez vous voir sur vos lames ?
- ✓ Imaginez votre activité dans 20 ans.

Prochain Niveau

- Dans un prochain cours basé sur l'analyse d'articles, on abordera des aspects plus techniques liés aux techniques de représentation et d'apprentissage de l'IA pour l'ACP et notamment l'analyse des WSI.
- Exemple disponible avec quelques annotations si vous le souhaitez :



Hierarchical graph representations in digital pathology

Pushpak Pati^{a,b,*}, Guillaume Jaume^{a,c}, Antonio Foncubierto-Rodríguez^a, Florinda Feroce^d, Anna Maria Anniciello^d, Giosue Scognamiglio^d, Nadia Brancati^e, Maryse Fiche^f, Estelle Dubruc^g, Daniel Riccio^e, Maurizio Di Bonito^d, Giuseppe De Pietro^e, Gerardo Botti^d, Jean-Philippe Thiran^c, Maria Frucci^e, Orcun Goksel^{h,i}, Maria Gabrani^a

^aIBM Zurich Research Lab, Zurich, Switzerland

^bComputer-Assisted Applications in Medicine, ETH Zurich, Zurich, Switzerland

^cSignal Processing Laboratory 5, EPFL, Lausanne, Switzerland

^dNational Cancer Institute - IRCCS-Fondazione Pascale, Naples, Italy

^eInstitute for High Performance Computing and Networking - CNR, Naples, Italy

^fAurigen - Centre de Pathologie, Lausanne, Switzerland

^gLausanne University Hospital, Lausanne, Switzerland

^hDepartment of Information Technology, Uppsala University, Sweden

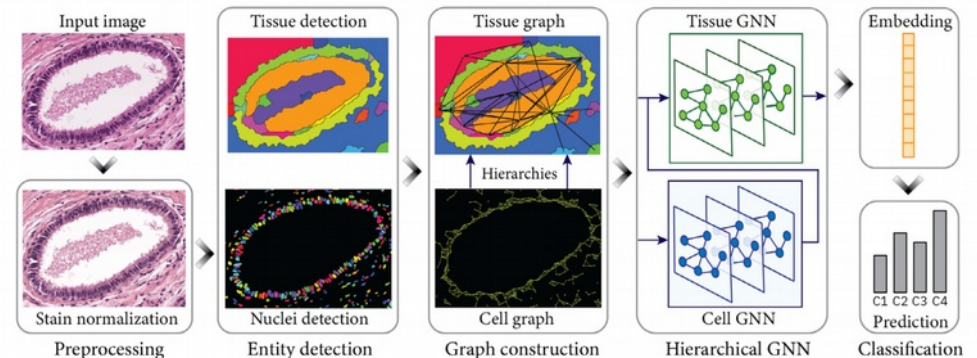


Fig. 2. Overview of the proposed hierarchical entity-graph based tissue analysis methodology. Following some pre-processing, a hierarchical entity-graph representation of a tissue is constructed, and it is processed via a hierarchical graph neural network to learn the mapping from tissue compositions to respective tissue categories. (Figure is best viewed in color).

Nos publis récentes

<https://pubmed.ncbi.nlm.nih.gov/?term=lomenie&sort=date>



Page 1

- 1 **Artificial intelligence-based pathology as a biomarker of sensitivity to atezolizumab-bevacizumab in patients with hepatocellular carcinoma: a multicentre retrospective study.**
Cite Zeng Q, Klein C, Caruso S, Maille P, Allende DS, Minguez B, Iavarone M, Ningharhari M, Casadei-Gardini A, Pedica F, Rimini M, Perbellini R, Boulagnon-Rombi C, Heurgué A, Maggioni M, Rela M, Vij M, Baulande S, Legoux P, Lameiras S; HCC-AI study group; Bruges L, Gnemmi V, Nault JC, Campani C, Rhee H, Park YN, Iñarrairaegui M, Garcia-Porrero G, Argemi J, Sangro B, D'Alessio A, Scheiner B, Pinato DJ, Pinter M, Paradis V, Beaufrère A, Peter S, Rimassa L, Di Tommaso L, Vogel A, Michalak S, Boursier J, Loménie N, Ziol M, Calderaro J.
Share Lancet Oncol. 2023 Dec;24(12):1411-1422. doi: 10.1016/S1470-2045(23)00468-0. Epub 2023 Nov 8. PMID: 37951222
- 2 **Can AI predict epithelial lesion categories via automated analysis of cervical biopsies: The TissueNet challenge?**
Cite Loménie N, Bertrand C, Fick RHJ, Ben Hadj S, Tayart B, Tilmant C, Farré I, Azdad SZ, Dahmani S, Dequen G, Feng M, Xu K, Li Z, Prevot S, Bergeron C, Bataillon G, Devouassoux-Shisheboran M, Glaser C, Delaune A, Valmary-Degano S, Bertheau P.
Share J Pathol Inform. 2022 Oct 5;13:100149. doi: 10.1016/j.jpi.2022.100149. eCollection 2022. PMID: 36605109 **Free PMC article.**
- 3 **Artificial intelligence predicts immune and inflammatory gene signatures directly from hepatocellular carcinoma histology.**
Cite Zeng Q, Klein C, Caruso S, Maille P, Laleh NG, Sommacale D, Laurent A, Amaddeo G, Gentien D, Rapinat A, Regnault H, Charpy C, Nguyen CT, Tournigand C, Brustia R, Pawlotsky JM, Kather JN, Maiuri MC, Loménie N, Calderaro J.
Share J Hepatol. 2022 Jul;77(1):116-127. doi: 10.1016/j.jhep.2022.01.018. Epub 2022 Feb 7. PMID: 35143898
- 4 **[The first data challenge of the french society of pathology: An international competition in 2020, a research tool in A.I. for the future?]**
Cite Delaune A, Valmary-Degano S, Loménie N, Zryouil K, Benyahia N, Trassard O, Eraville V, Bergeron C, Devouassoux-Shisheboran M, Glaser C, Bataillon G, Bacry E, Combes S, Prevot S, Bertheau P.
Share Ann Pathol. 2022 Mar;42(2):119-128. doi: 10.1016/j.annpat.2021.10.002. Epub 2022 Jan 7. PMID: 35012784 **French.**

- 5 **Artificial intelligence for solid tumour diagnosis in digital pathology.**
Cite Klein C, Zeng Q, Arbaretaz F, Devèvre E, Calderaro J, Lomenie N, Maiuri MC.
Share Br J Pharmacol. 2021 Nov;178(21):4291-4315. doi: 10.1111/bph.15633. Epub 2021 Sep 13. PMID: 34302297 **Free article.** **Review.**
- 6 **Pembrolizumab with Capox Bevacizumab in patients with microsatellite stable metastatic colorectal cancer and a high immune infiltrate: The FFCD 1703-POCH1 trial.**
Cite Gallois C, Emile JF, Kim S, Monteryard C, Gilabert M, Bez J, Lièvre A, Dahan L, Laurent-Puig P, Mineur L, Coriat R, Legoux JL, Hautefeuille V, Pheip JM, Lecomte T, Sokol H, Capron C, Randrian V, Lepage C, Lomenie N, Kurtz C, Taieb J, Tougeron D.
Share Dig Liver Dis. 2021 Oct;53(10):1254-1259. doi: 10.1016/j.dld.2021.06.009. Epub 2021 Jun 30. PMID: 34215534 **Free article.**

<https://dblp.org/pid/83/3109.html>

2023

 [c26]  Zhuxian Guo, Qitong Wang, Henning Müller, Themis Palpanas, Nicolas Loménie, Camille Kurtz: **A Hierarchical Transformer Encoder to Improve Entire Neoplasm Segmentation on Whole Slide Images of Hepatocellular Carcinoma.** ISBI 2023: 1-5