

# AI & radiology

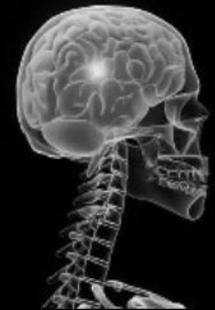
ZELEŇÁK Kamil

Department of Radiology

Comenius University's Jessenius Faculty of Medicine

and University Hospital

Martin, Slovakia





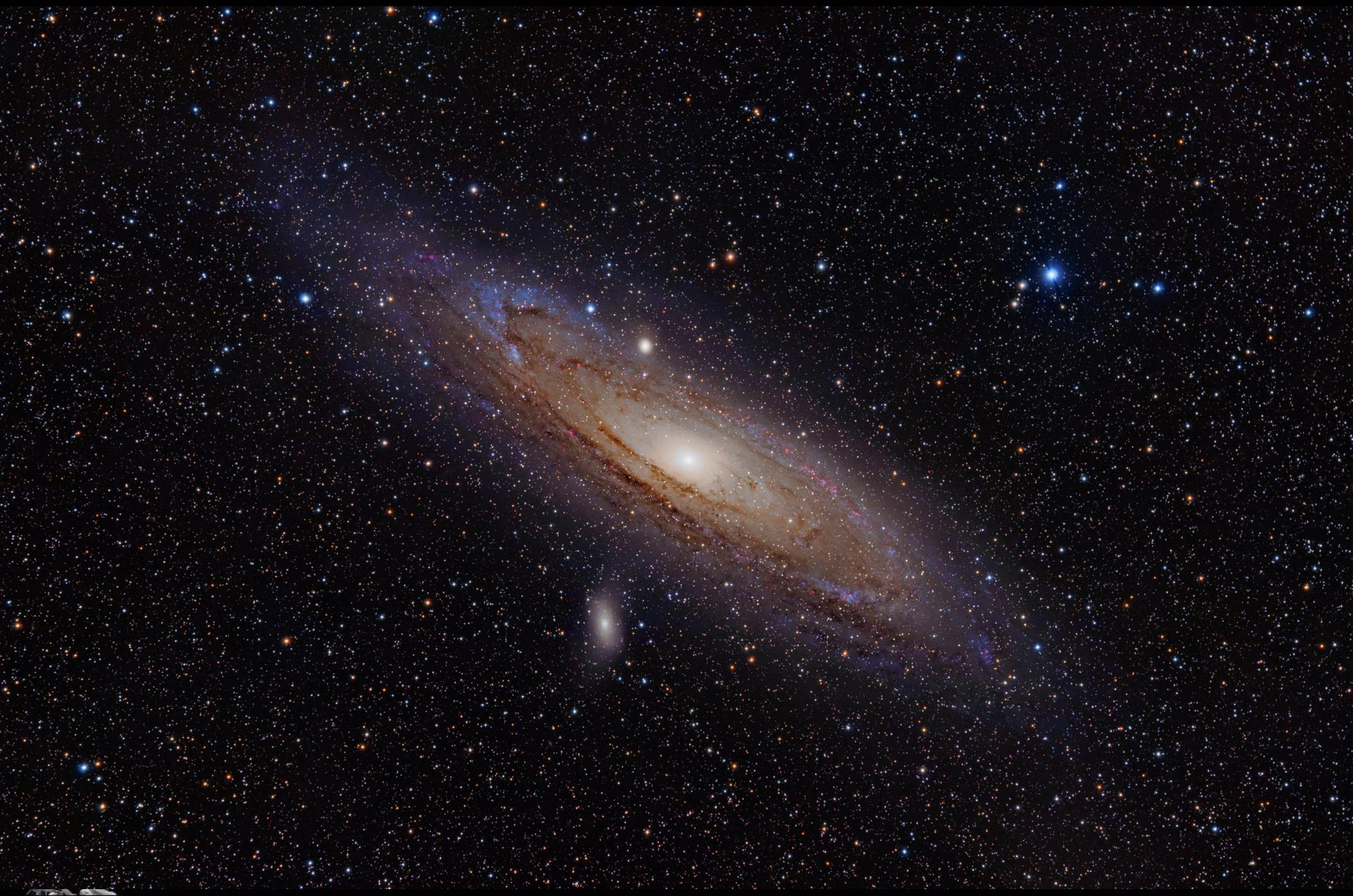


# The Artificial Intelligence

## Beethoven's last symphony

- Finished by AI





# The Artificial Intelligence

Article / Table 1.



# The Artificial Intelligence

**Suitable for**

**Stroke detection**

**Patient management**

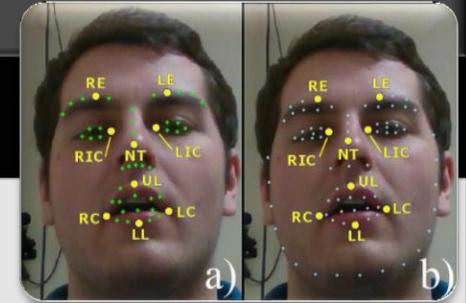
**Prediction**

**Rehabilitation**



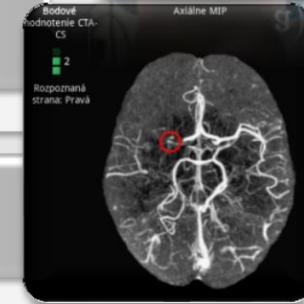
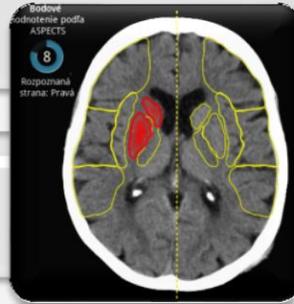
# The Artificial Intelligence

Stroke detection

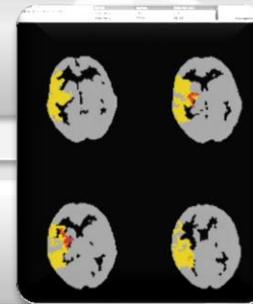
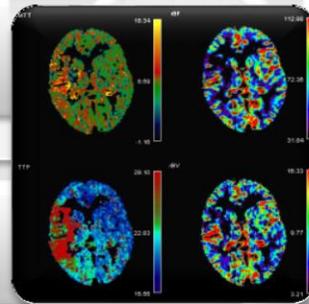


Prehospital

ASPECT



LVO, collateral score



Mismatch



# The Artificial Intelligence

Prediction

Thrombectomy success

Hemorrhagic transformation

Final volume of ischemia

Clinical result

Neuroradiology  
<https://doi.org/10.1007/s00234-022-03070-0>

INTERVENTIONAL NEURORADIOLOGY



**Can machine learning of post-procedural cone-beam CT images in acute ischemic stroke improve the detection of 24-h hemorrhagic transformation? A preliminary study**

Valerio Da Ros<sup>1</sup> · Andrea Duggento<sup>1</sup> · Armando Ugo Cavallo<sup>1</sup> · Luigi Bellini<sup>1</sup> · Francesca Pitocchi<sup>1</sup> · Nicola Toschi<sup>1</sup> · Alfredo Paolo Mascolo<sup>2</sup> · Fabrizio Sallustio<sup>2</sup> · Francesca Di Giuliano<sup>1</sup> · Marina Diomedi<sup>2</sup> · Roberto Floris<sup>1</sup> · Francesco Garaci<sup>1</sup> · Kamil Zeleňák<sup>3</sup> · Ilaria Maestrini<sup>2</sup> 



# The Artificial Intelligence

Rehabilitation

Movement

Speech

Cognitive functions

BEING *Sophia*



# Why AI

## Human errors

### Abstract

**Background and purpose:** Medical errors can result in significant morbidity and mortality. The goal of our study is to evaluate correlation between shift volume and errors made by attending neuroradiologists at an academic medical center, using a large data set.

**Materials and methods:** CT and MRI reports from our Neuroradiology Quality Assurance database (years 2014 - 2020) were searched for attending physician errors. Data were collected on shift volume, category of missed findings, error type, interpretation setting, exam type, clinical significance.

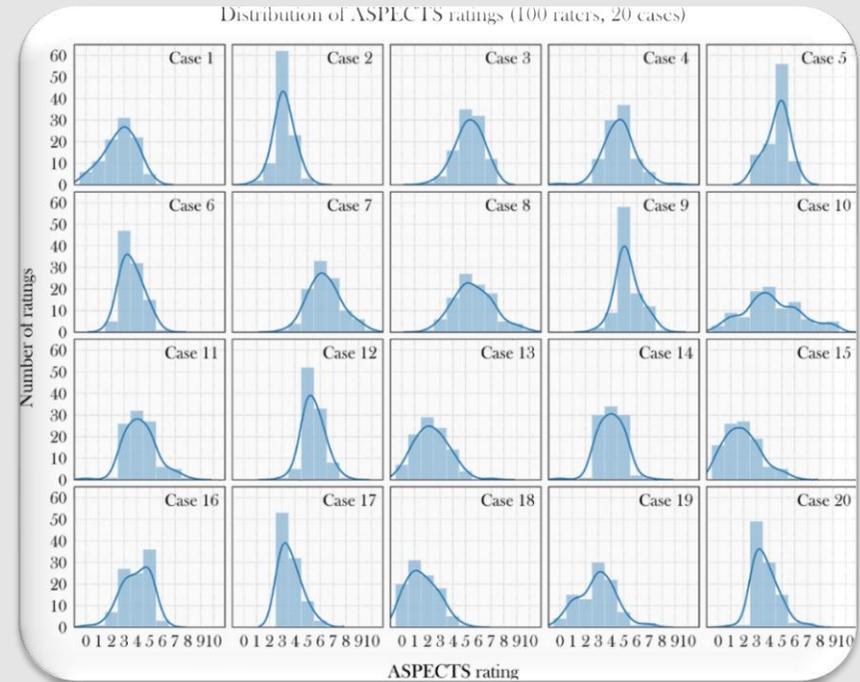
**Results:** 654 reports contained diagnostic error. There was a significant difference between mean volume of interpreted studies on shifts when an error was made compared with shifts in which no error was documented (46.58 (SD=22.37) vs 34.09 (SD=18.60),  $p < 0.00001$ ); and between shifts when perceptual error was made compared with shifts when interpretive errors were made (49.50 (SD=21.9) vs 43.26 (SD=21.75),  $p = 0.0094$ ). 59.6% of errors occurred in the emergency/inpatient setting, 84% were perceptual and 91.1% clinically significant. Categorical distribution of errors was: vascular 25.8%, brain 23.4%, skull base 13.8%, spine 12.4%, head/neck 11.3%, fractures 10.2%, other 3.1%. Errors were detected most often on brain MRI (25.4%), head CT (18.7%), head/neck CTA (13.8%), spine MRI (13.7%).

**Conclusion:** Errors were associated with higher volume shifts, were primarily perceptual and clinically significant. We need National guidelines establishing a range of what is a safe number of interpreted cross-sectional studies per day.

# ASPECT

## Interobserver Agreement

- M3 region
- Lowest level of agreement



# The Artificial Intelligence

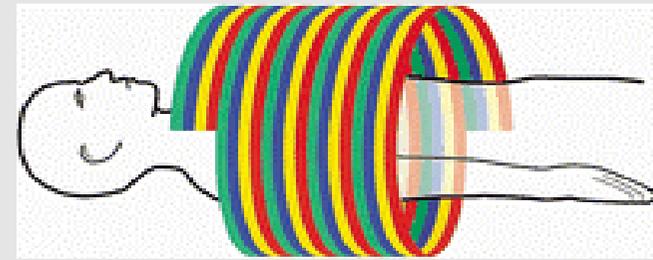
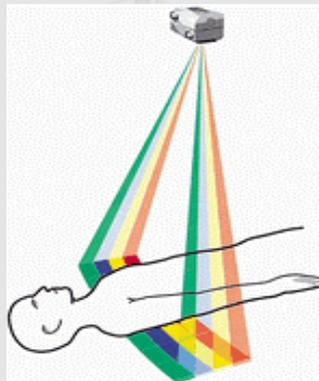
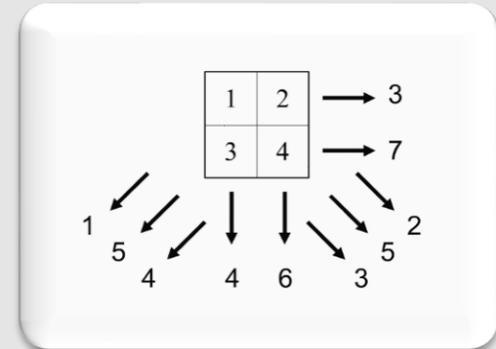
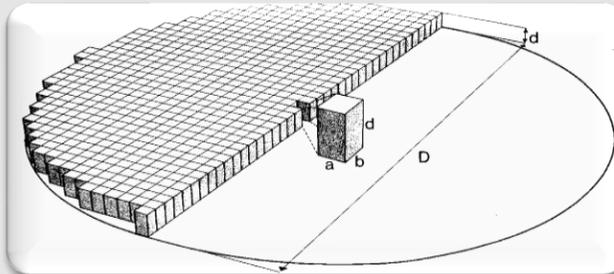
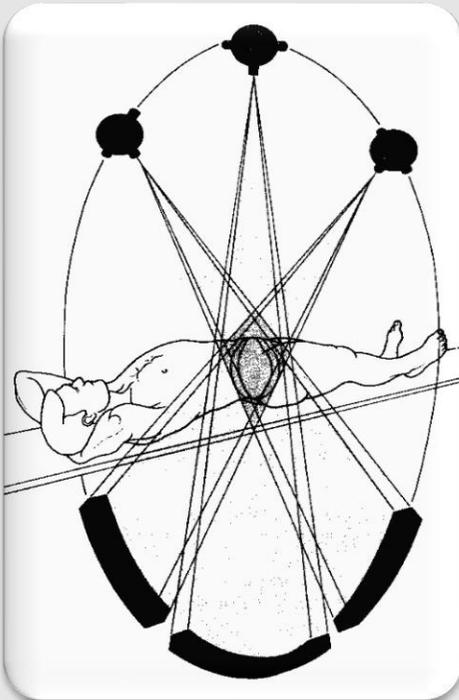
## Why AI?

- BE FAST
- No limits
- Effectivity
- Objectivity
- Quality
- Homogeneous interpretation
- Patient selection
- Save finances



# CT

## Radiology



@zelenakkamil



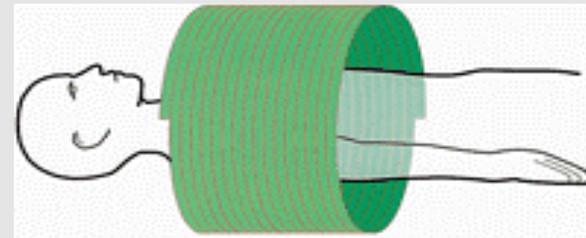
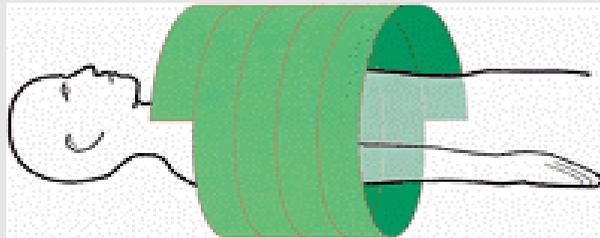
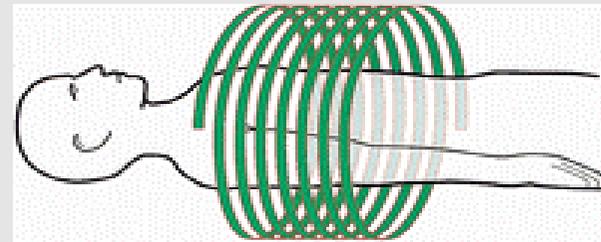
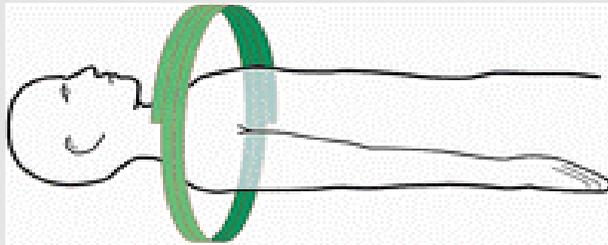
kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

# CT

## Slice thickness and slice increment



@zelenakkamil



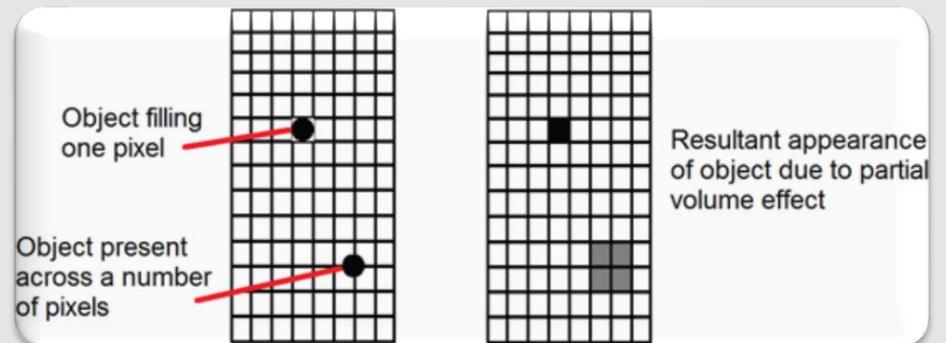
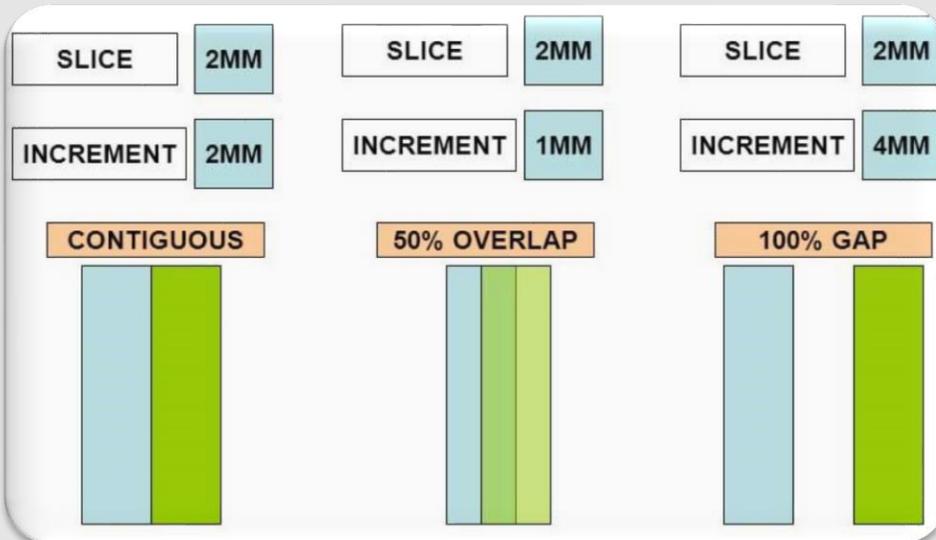
kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

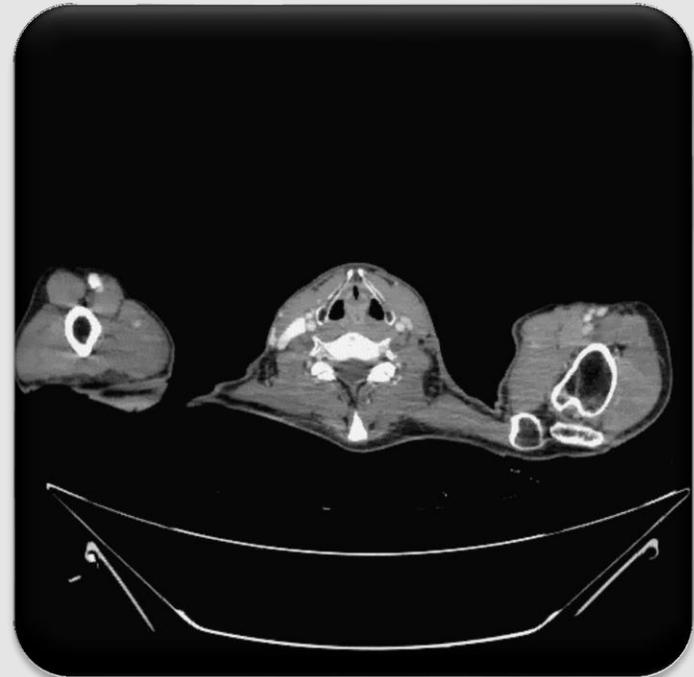
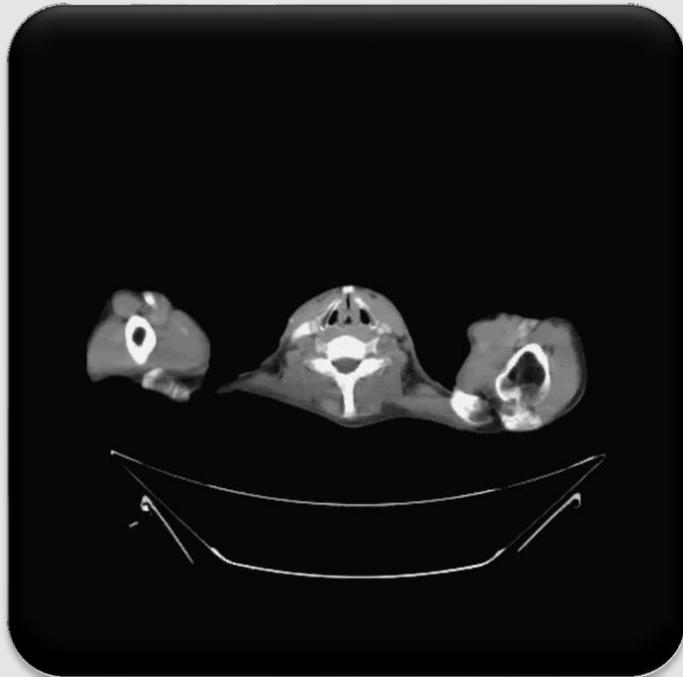
# CT

## Slice thickness and slice increment



# CT

Slice thickness (10 mm vs 1 mm)



@zelenakkamil



kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

# CT

## Coronal reconstruction



@zelenakkamil



kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

# Human 1.0

## Burnout syndrome



@zelenakkamil



kamil-zelenak

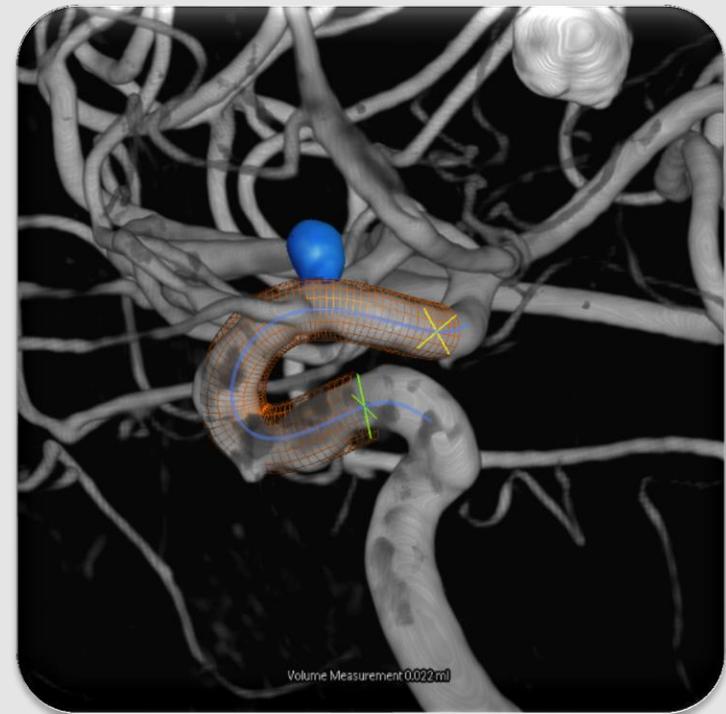


zelenak@unm.sk kamil.zelenak@uniba.sk

# The Artificial Intelligence

## Head

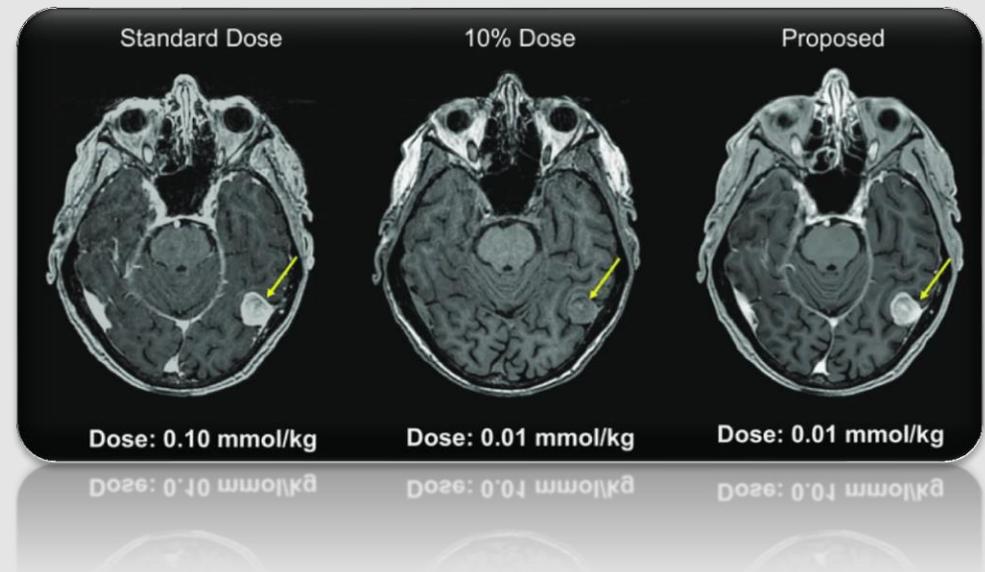
- Ischemic Stroke
- Hemorrhage
- Vessels
  - Occlusion
  - Microvascular diseases
  - Macrovascular diseases
    - Stenoses
    - Aneurysms
- Traumatic brain injuries



# The Artificial Intelligence

## Head

- Tumors
- Lesions quantification
  - Anatomical distribution
  - Resolving, stable or active
    - Volume and count
    - Color-coded
  - Multiple sclerosis
- Brain development
- Brain atrophy
- Epilepsy



# The Artificial Intelligence

## Chest & Spine

- X-rax

Pneumothorax  
Pneumonia  
Mediastinal Widening  
Cardiomegaly



## CT

Pulmonary embolism  
Aortic Aneurysms & Dissection  
Lung nodules  
Lymph nodes  
Rib fractures  
Bone lesions



@zelenakkamil



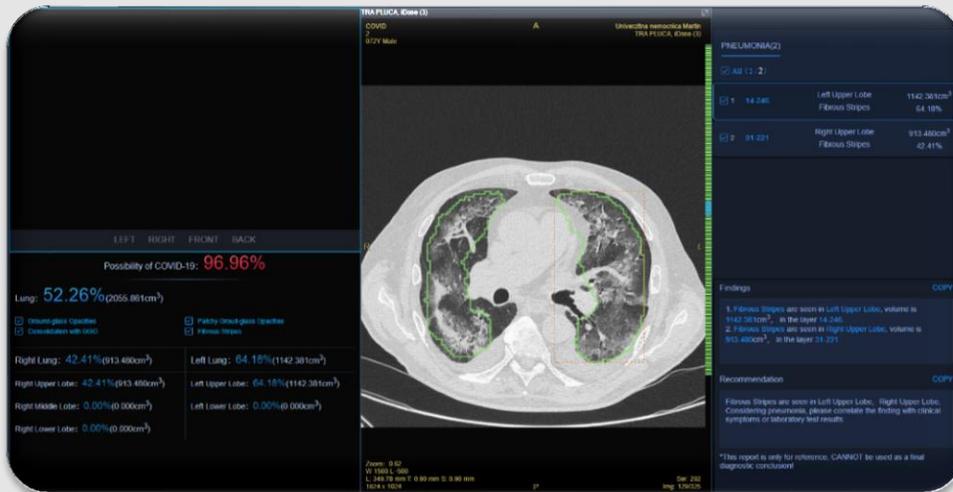
kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

# The Artificial Intelligence

## Radiology



@zelenakkamil



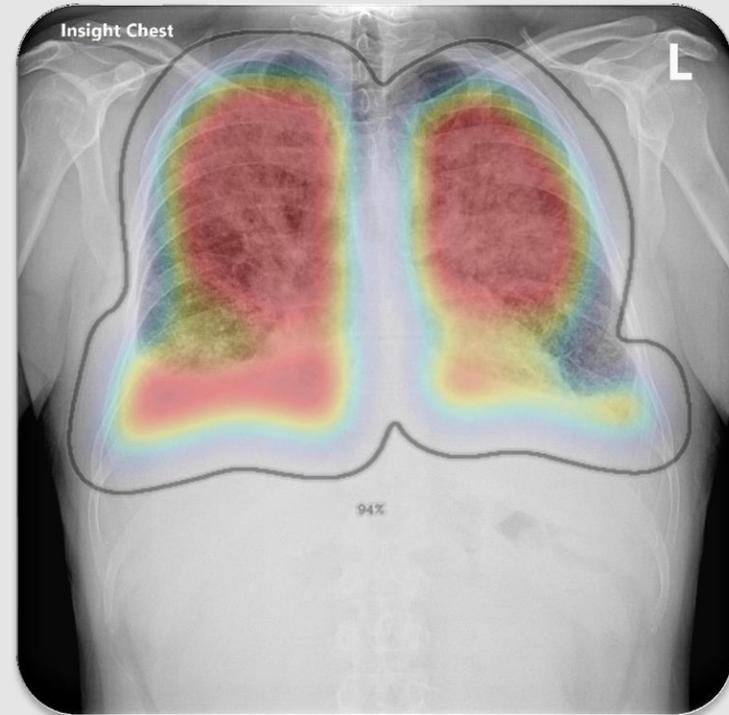
kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

# The Artificial Intelligence

## Radiology



@zelenakkamil



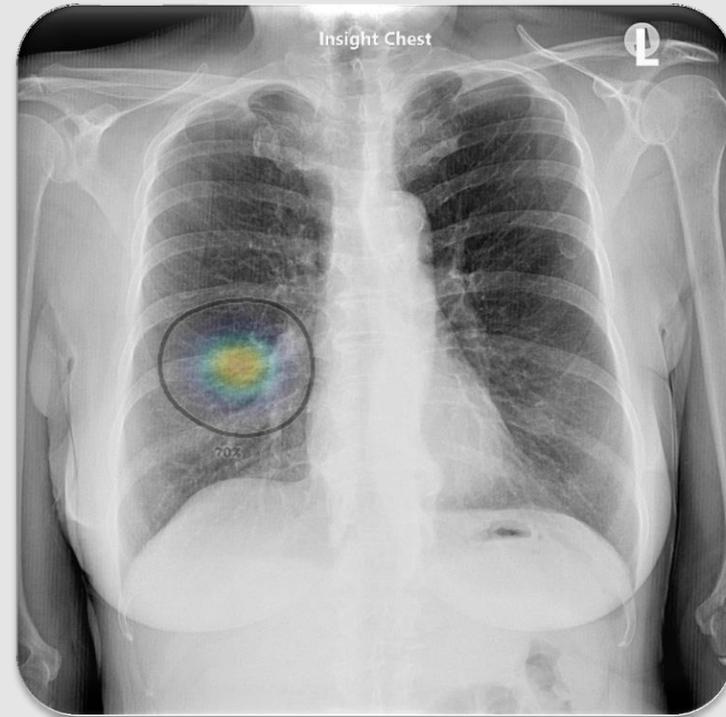
kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

# The Artificial Intelligence

## Radiology



@zelenakkamil



kamil-zelenak

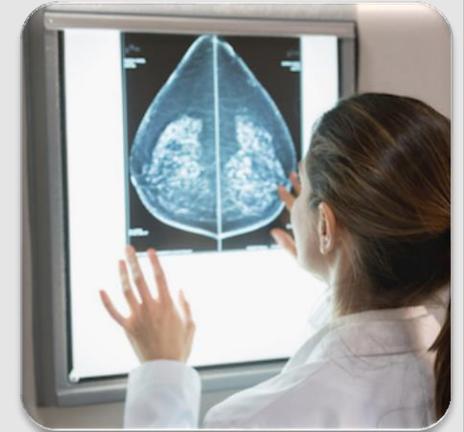
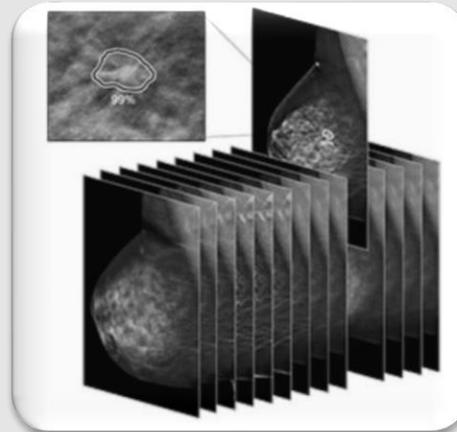


zelenak@unm.sk kamil.zelenak@uniba.sk

# The Artificial Intelligence

## The breast cancer detection

- In the 3-D tomosynthesis
- Matches two doctors
  - *healthmanagement.org*
- Improves breast cancer screening and diagnosis



# The Artificial Intelligence

## Abdomen

- Tumors
  - Liver, kidney, lymph nodes, bone
- Active hemorrhage
- Aortic aneurysms & dissection
- Free air
- Appendicitis
- Bowel obstructions



@zelenakkamil



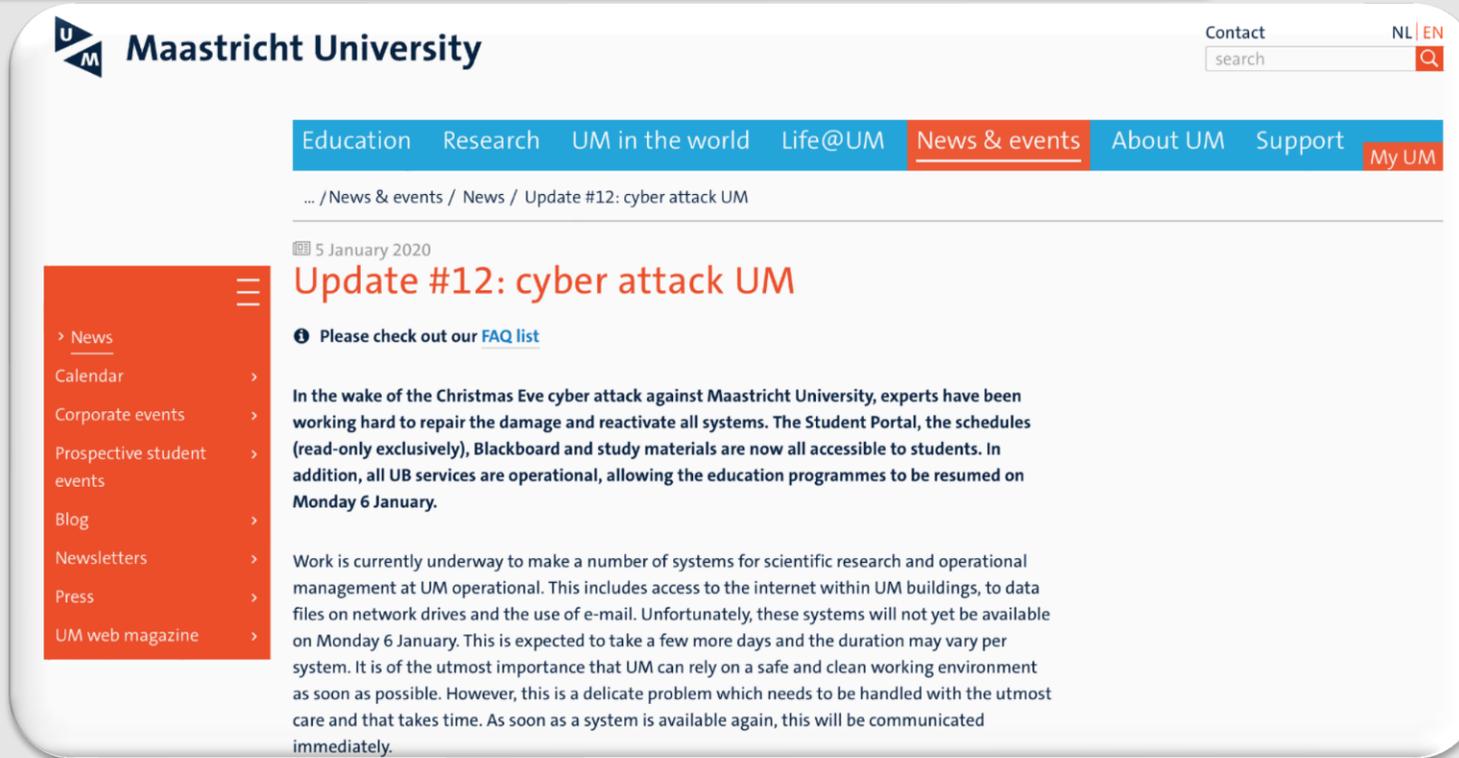
kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

# The Artificial Intelligence

## Data safety



The screenshot shows the Maastricht University website. At the top left is the Maastricht University logo and name. On the top right, there are links for 'Contact', 'NL', and 'EN', along with a search bar. A navigation menu below the header includes 'Education', 'Research', 'UM in the world', 'Life@UM', 'News & events' (highlighted), 'About UM', 'Support', and 'My UM'. The breadcrumb trail reads: '... /News & events / News / Update #12: cyber attack UM'. The article is dated '5 January 2020' and titled 'Update #12: cyber attack UM'. A sub-header says 'Please check out our FAQ list'. The main text states: 'In the wake of the Christmas Eve cyber attack against Maastricht University, experts have been working hard to repair the damage and reactivate all systems. The Student Portal, the schedules (read-only exclusively), Blackboard and study materials are now all accessible to students. In addition, all UB services are operational, allowing the education programmes to be resumed on Monday 6 January.' A second paragraph follows: 'Work is currently underway to make a number of systems for scientific research and operational management at UM operational. This includes access to the internet within UM buildings, to data files on network drives and the use of e-mail. Unfortunately, these systems will not yet be available on Monday 6 January. This is expected to take a few more days and the duration may vary per system. It is of the utmost importance that UM can rely on a safe and clean working environment as soon as possible. However, this is a delicate problem which needs to be handled with the utmost care and that takes time. As soon as a system is available again, this will be communicated immediately.'



@zelenakkamil



kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

# The Artificial Intelligence

A third eye for doctors



# The Artificial Intelligence

## Conclusion

- Scheduling
- Decision making
- Protocol optimization
- Workflow
- Reporting
- Billing



TVZME' ŽE BY SA DALO...



@zelenakkamil



kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk

# The Artificial Intelligence

## Conclusion

- Precise
- Effectivity
- Prediction
- Save money
- Intelligent



@zelenakkamil



kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk



**GAME  
OVER**

**OVER**



# Contact

- @zelenakkamil



- kamil-zelenak



@zelenakkamil



kamil-zelenak



zelenak@unm.sk kamil.zelenak@uniba.sk