

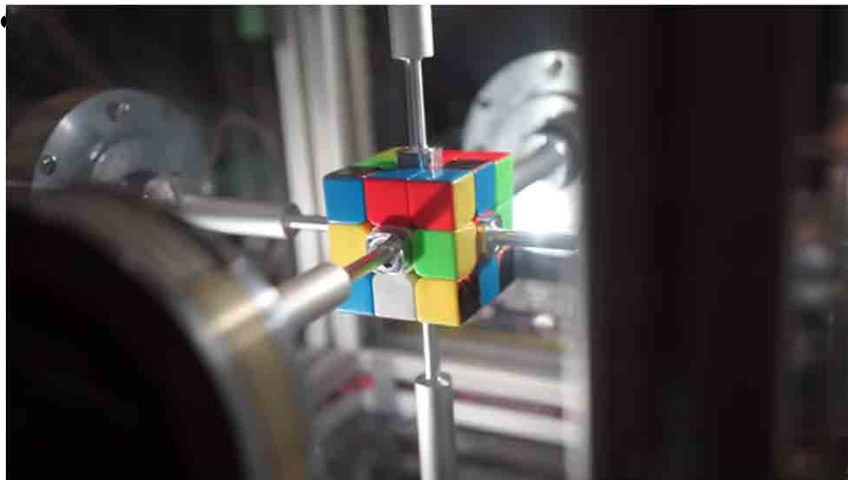
**Mellkas RTG vizsgálatok számítógépes leletezése:  
kezdeti tapasztalataink egy mesterséges intelligencia-  
alapú képfelismerő és értékelő (ChestEye) rendszerrel**

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Kft., Iconomix Kft.

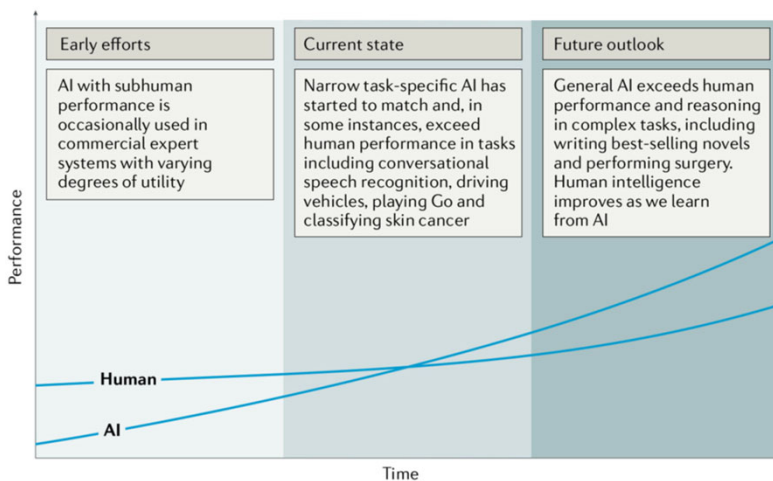
1

## Mesterséges intelligencia



2

## Mesterséges vs. humán intelligencia



3

## Képfelismerés – computer vision (cv)

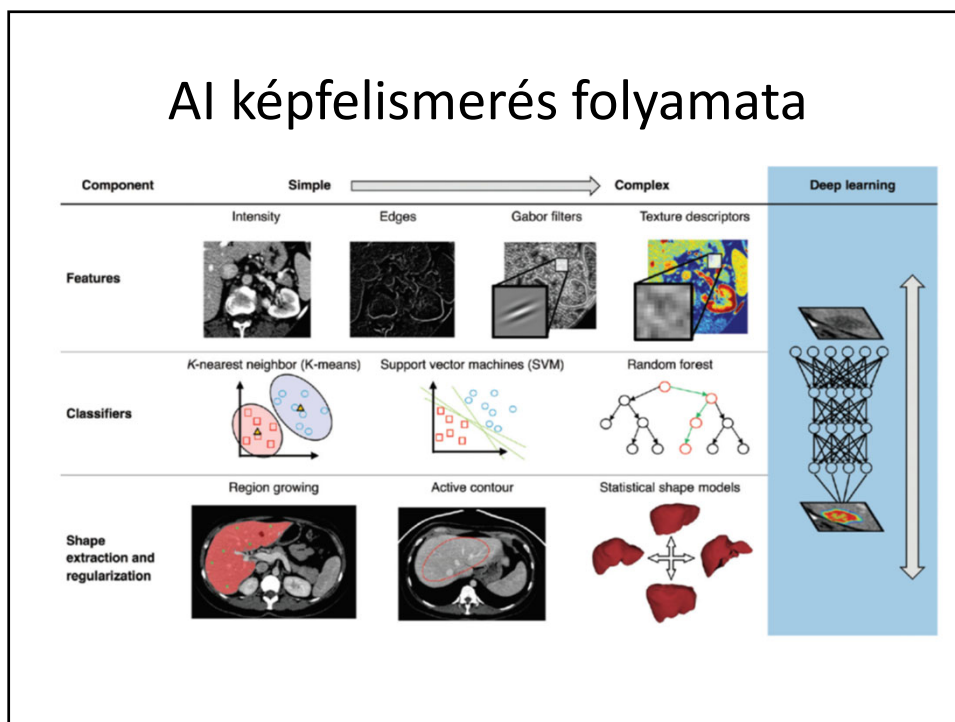
- az ember gyorsan tanul – elég egy képet, arcot

**Object Classification:** What broad category of object is in this photograph?  
**Object Identification:** Which type of a given object is in this photograph?  
**Object Verification:** Is the object in the photograph?  
**Object Detection:** Where are the objects in the photograph?  
**Object Landmark Detection:** What are the key points for the object in the photograph?  
**Object Segmentation:** What pixels belong to the object in the image?  
**Object Recognition:** What objects are in this photograph and where are they?

cv teljesítés nehézsége: nem világos, hogy az emberi látórendszer hogyan működik

4

## AI képfelismerés folyamata



5

<https://cloud.google.com/vision>

Try the API

Faces **Objects** Labels Web Properties Safe Search

The screenshot shows the Google Cloud Vision API interface. The "Objects" tab is selected, and a portrait of a man is analyzed. The results show two detected objects:

Man	89%
Tie	53%

The image file name is 220px-Roentgen2.jpg.

6

220px-Roentgen2.jpg

Facial Hair 98%

Hair 98%

Beard 96%

Gentleman 88%

Moustache 87%

Chin 83%

Forehead 78%

Portrait 52%

Show JSON

RESET NEW FILE

7

Try the API

220px-Roentgen2.jpg

Web Entities:

Wilhelm Röntgen	16.8315
X-ray	0.7304
Discovery	0.6919
Radiography	0.5211
Radiation	0.4291
Radiology	0.421
Physicist	0.4026
Science	0.3636
Medicine	0.3493
Physics	0.3211
Platinocyanide	0.3145
Roentgen	0.2902
Electromagnetic radiation	0.2874


Show JSON

RESET NEW FILE

8

## Milyen fajta?

Objects   Labels   Web   Properties   Safe Search



weimari-vizsla-1.jpg

Dog	100%
Mammal	99%
Vertebrate	99%
Dog Breed	98%
Canidae	98%
Weimaraner	97%
Pointing Breed	88%
Carnivore	87%


Show JSON ▾

RESET   NEW FILE

9

## Milyen fajta?

Objects   Labels   Web   Properties   Safe Search



westie.jpg

Dog	100%
Mammal	99%
Vertebrate	99%
Dog Breed	98%
Canidae	98%
West Highland White Terrier	97%
Terrier	96%
Carnivore	93%

Show JSON ▾

RESET   NEW FILE

10

## Mi kutyánk 1.

The screenshot shows a web application interface with a photo of a dog on the left and a list of classification labels on the right. The interface has tabs for 'Objects', 'Labels', 'Web', 'Properties', and 'Safe Search'. The 'Labels' tab is selected. The photo is labeled '20190215\_220150.jpg'. The classification list includes the following items and percentages:

Label	Percentage
Mammal	99%
Vertebrate	99%
Canidae	98%
Dog Breed	98%
Shih Tzu	91%
Maltese	90%
Morkie	88%
Löwchen	88%
Lhasa Apso	87%
Kyi-leo	86%
Carnivore	85%
Havanese	85%

11

## Mi kutyánk 2.

The screenshot shows a web application interface with a photo of a dog on the left and a list of classification labels on the right. The interface has tabs for 'Objects', 'Labels', 'Web', 'Properties', and 'Safe Search'. The 'Labels' tab is selected. The photo is labeled '20190214\_184451.jpg'. The classification list includes the following items and percentages:

Label	Percentage
Dog	100%
Mammal	99%
Dog Breed	96%
Canidae	98%
Shih Tzu	90%
Tibetan Terrier	89%
Carnivore	85%
Lhasa Apso	85%
Companion Dog	83%
Petit Basset Griffon Vendéen	78%
Floor	75%
Havanese	75%

12

## Differenciáldiagnosztika - Quiz1



Shih tzu



Máltai uszkár



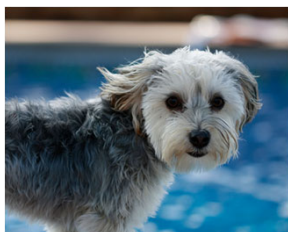
Tibeti terrier



Petit Basset Griffon

13

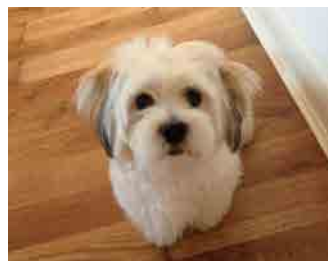
## Differenciáldiagnosztika - Quiz 2



Morkie



Lhasa apso



Kyi-leo



Löwchen



havannai

14

## Radiológiai képfelismerés

- mammography
- liver mass (CT)
- MR knee abnormality
- cerebral aneurysm (MRA)
- microbleed detection (SWI)
- intracranial bleeding, midline shift
- ischemic stroke
- segmentation of white matter hyperintensities
- coronary calcification
- prognosis of non-small cell lung cancer
- genomic status of glioma
- liver fibrosis staging
- lymph node detection
- lung nodule (LDCT)
- tuberculosis screening (XR)
- bone age
- bone fracture detection
- degenerative bone changes – extremity + spine
- etc.

15

## Mellkas RTG diagnosztika


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### Oxipit ChestEye

Oxipit ChestEye is a CE certified suite of solutions for chest X-ray radiological workflow. The tools in the suite increase reporting productivity by generating preliminary reports, allow more accurate differential diagnosis by image-based search and case retrieval, and prioritize cases with urgent conditions for faster reporting.



### ChestEye CAD

*Automate your reporting*

**ChestEye CAD** is a fully automatic computer-aided diagnosis (CAD) chest X-ray solution. It provides preliminary reports (image in, report out) which then have to be approved by a radiologist. This way it enables the user to save time (internal trial shows >20% savings), increase accuracy (e.g. decrease overlooked secondary findings), optimize screening / triage, and introduce faster reporting practices. The solution can be integrated with PACS/RIS/HIS/CRM infrastructure.



16



## Oxipit – ChestEye (AUC 87%)

- 75 diagnózis
- képfelismerés
- előzetes lelet elkészítése dedikált szótár/szöveggyűjtemény segítségével

Linear Atelectasis, Lobar Collapse, Enlarged Heart, Edema, Pleural Effusion, Loculated Effusion, Fissural Thickening, Bullous Emphysema, Pulmonary Emphysema, Subcutaneous Emphysema, Consolidation, Pneumothorax, Tuberculosis, Hypoventilation, Lymphadenopathy, Hypertension, Granuloma, Lymph Node Calcification, Elevated Diaphragm, Dislocated Mediastinum, Widened Mediastinum, Congestion, Fibrosis, Interstitial Markings, Pleural Adhesion, Hilar Prominence, Mass, Cyst, Pulmonary Cavity, Sarcoidosis, Hernia, Removed Lung, Enlarged Aorta, Goitre, Thymus, Aortic Sclerosis, Respiratory Distress Syndrome, Retrosternal Airspace Obliteration, Pleural Thickening, Pneumomediastinum, Pericardial Effusion, Pleural Plaque, Pneumoperitoneum, CV Catheter RA Placement, CV Catheter SVC Placement, HD Catheter RA Placement, HD Catheter SVC Placement, Catheter Malposition, Intubation, Intubation Malposition, Chest Tube, Sternal Wires, Endovascular Stent, Tracheal Stent, Esophageal Stent, Artificial Heart Valve, Intra Aortic Balloon, Ventricular Assist Device, Nasogastric Tube, Pacemaker, Spinal Implant, Zygus Lobe, Gastric Bubble, Bowel Gas, Barium Swallow, Abnormal Rib, Rib Resection, Spinal Compression Fracture, Spinal Degenerative Changes, Spondylosis, Osteoporosis, Kyphosis, Scoliosis, Ligament Ossification, Spinal Enthesopathy.

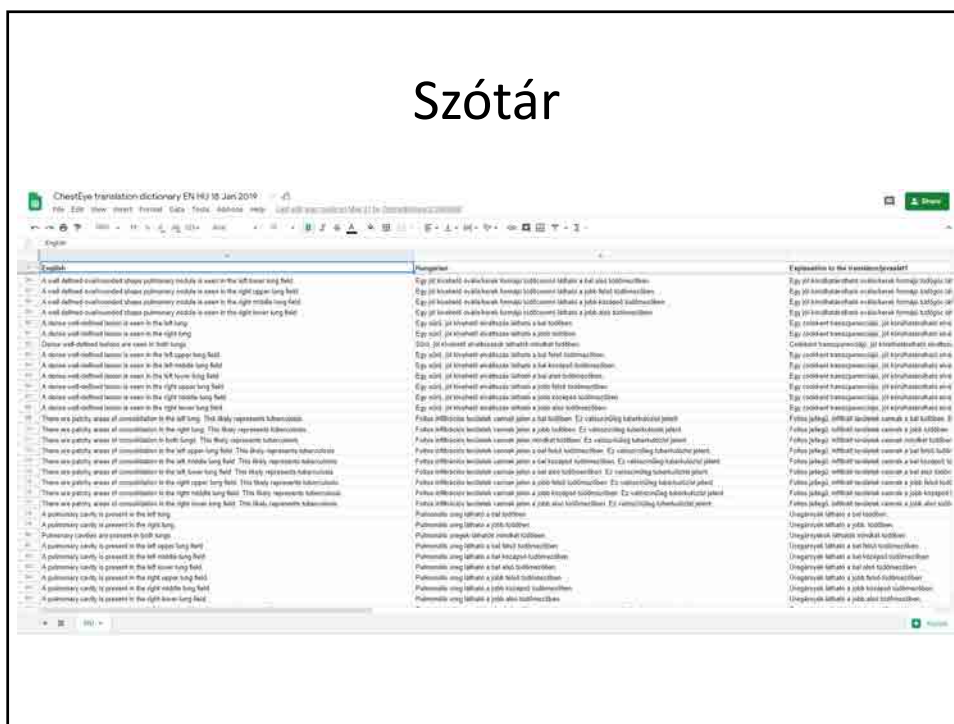
17

## Chesteye – Terasy integráció

- mellkas rtg vizsgálatok felismerése
- automatikus diagnosztika (heatmap)
- magyar szótár elkészítése az angol alapján
- automatikus előleletezés
- egyedi hozzáférés kialakítása
- radiológus validál és értékkel: értékelő panel

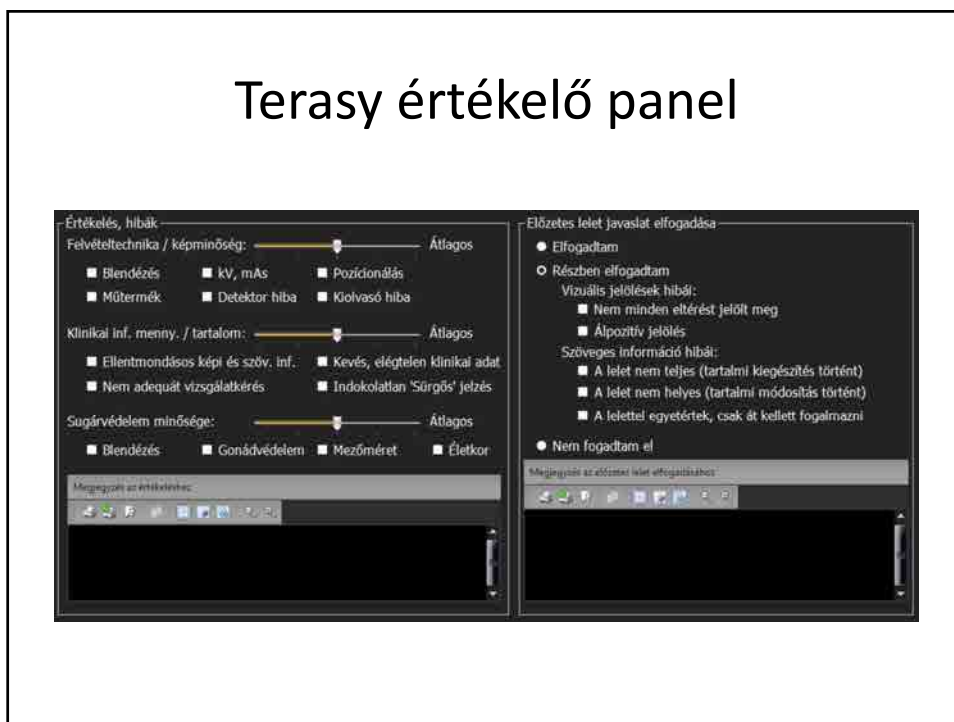
18

# Szótár



19

# Terasy értékelő panel



20

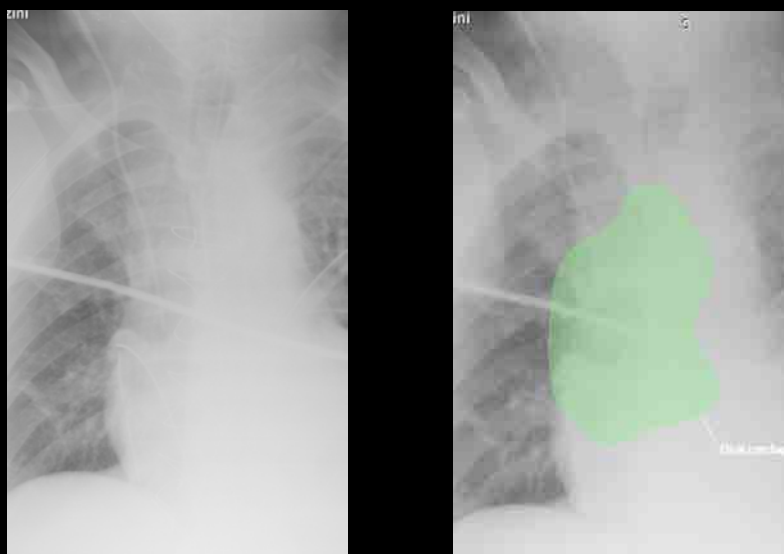
## Eredmények

Elfogadva	25	33,33%	33,33%
Nem elfogadott	2	2,67%	<b>66,67%</b>
Részben elfogadva	48	64,00%	
<b>Végösszeg</b>	<b>75</b>	<b>100,00%</b>	<b>100,00%</b>

	bejelölt	részben elfogadva	bejelölt	
álnegatív	11	48	22,92%	diagnosztikai tévedés
álpozitív	11	48	22,92%	diagnosztikai tévedés
szöveges információ nem teljes	34	48	70,83%	
szöveges információ nem helyes	19	48	39,58%	
szöveges információ megfogalmazással nem ért egyet	5	48	10,42%	

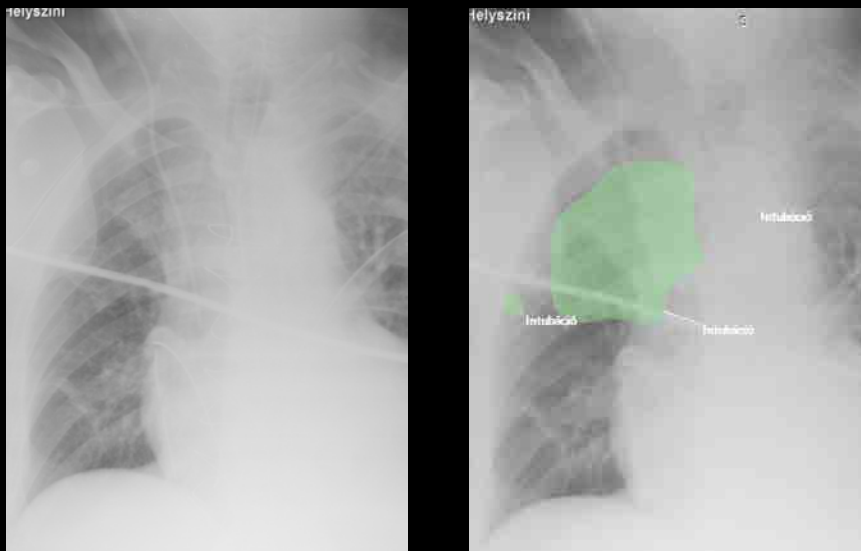
21

## AI1 – drót cerclage



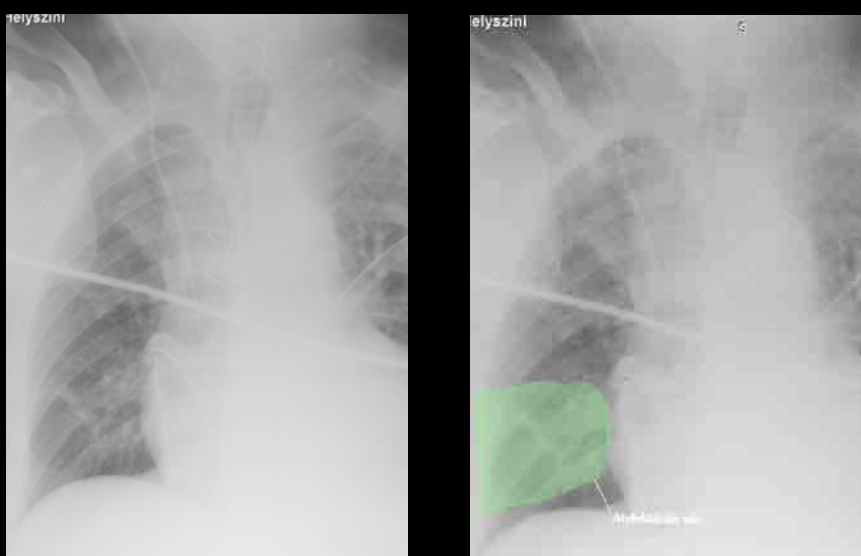
22

## AI2 – intubáció



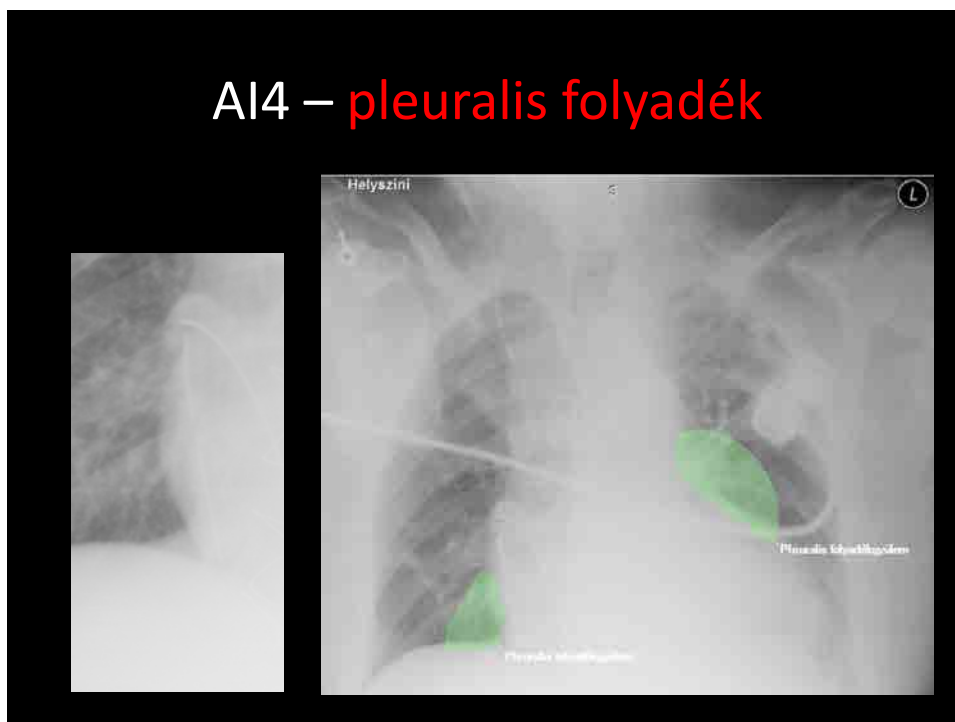
23

## AI3 – atelectasia



24

## AI4 – pleuralis folyadék



25

### Összefoglalás

- a Chesteye program sikeres integrációja megtörtént – rutin munkafolyamatban alkalmazható
- jó a negatív prediktív értéke
- komplexebb eseteket nehezebben értékeli helyesen, ezek további analízise szükséges
- a szótár javításra szorul
- jelenleg a radiológiai diagnosztikai alkalmazások általánosságban limitáltak – triage-olás
- tanítási algoritmus újragondolása szükséges

26

Köszönöm a figyelmet!

