Medical Image Processing Lab

Innopolis U

Scientific task:
High quality diagnosing of chest pathologies

Nodule - 8.7%

Mass - 7.6%

Pneumonia - 83 %

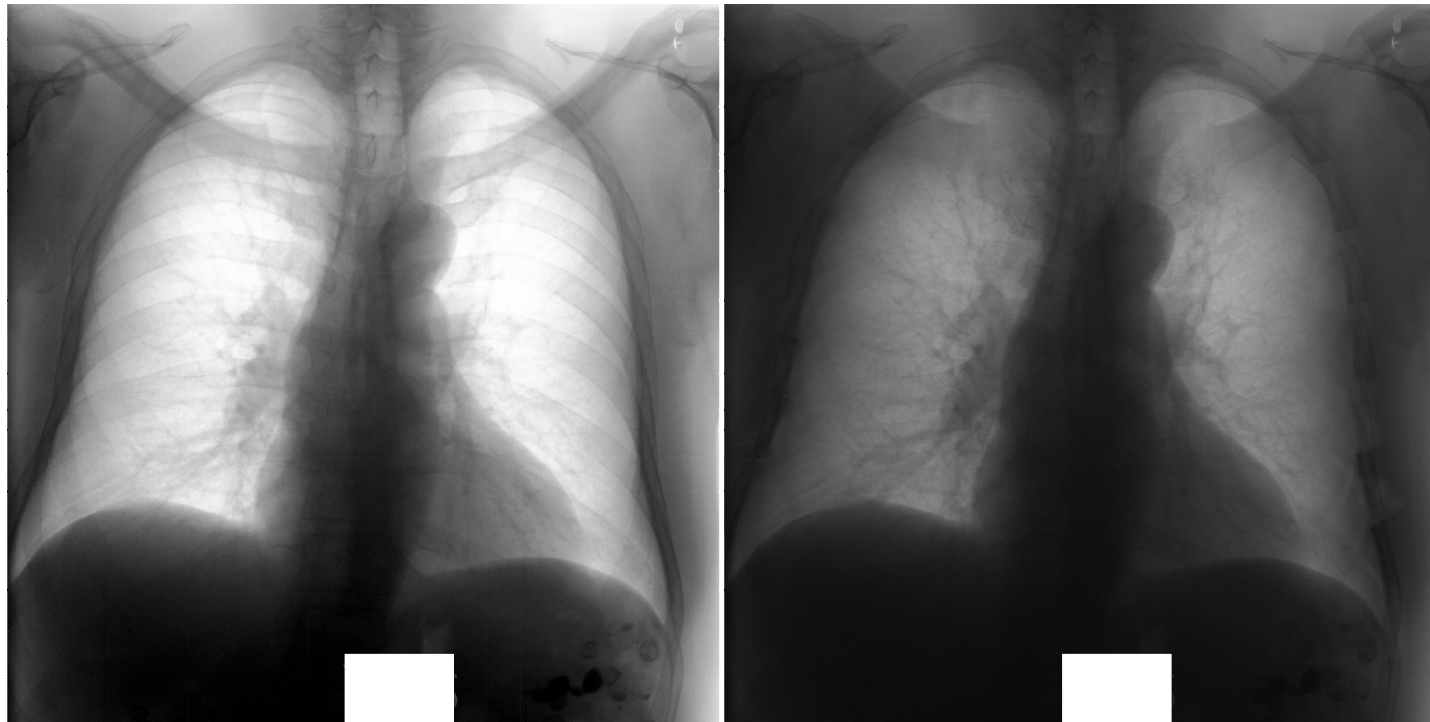Pathology - 87%

Scientific task:
Why is it important?

- Chest X-ray is relatively affordable (cheap) examination

- Understanding chest X-ray still is a challenging task even for experienced radiologist

Why is it challenging task?

1) Superimposed anatomical structure
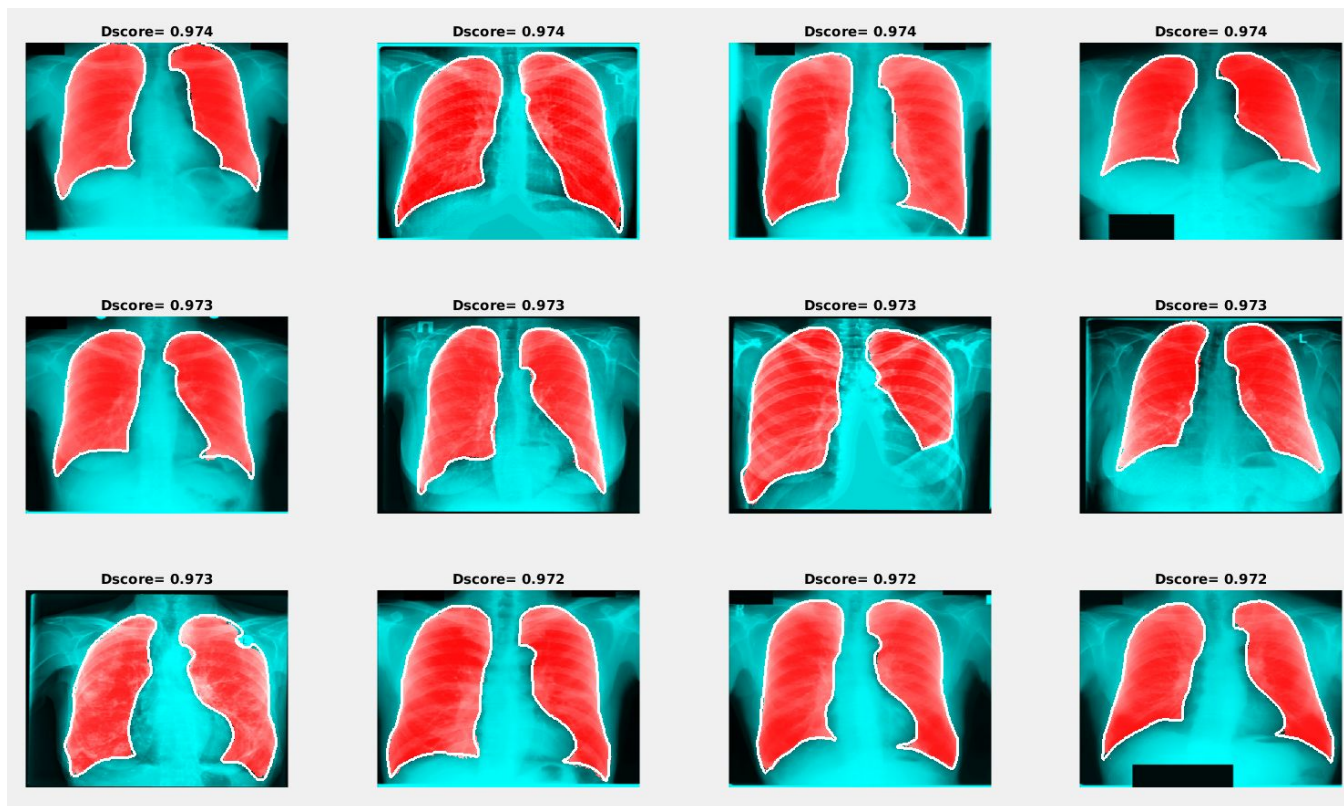2) High intra class variance due to various X-ray scanner producers

Combatting with difficulties: bone suppression

*Fully convolutional NN

*Autoencoders

# Combatting with difficulties: lung fields segmentation

*U-Net family NN

*Mask-RCNN

Pathologies classification

| Pathology	Wang et al. (2017)	Yao et al. (2017)	CheXNet (ours)
Atelectasis	0.716	0.772	**0.8094**
Cardiomegaly	0.807	0.904	**0.9248**
Effusion	0.784	0.859	**0.8638**
Infiltration	0.609	0.695	**0.7345**
Mass	0.706	0.792	**0.8676**
Nodule	0.671	0.717	**0.7802**
Pneumonia	0.633	0.713	**0.7680**
Pneumothorax	0.806	0.841	**0.8887**
Consolidation	0.708	0.788	**0.7901**
Edema	0.835	0.882	**0.8878**
Emphysema	0.815	0.829	**0.9371**
Fibrosis	0.769	0.767	**0.8047**
Pleural Thickening	0.708	0.765	**0.8062**
Hernia	0.767	0.914	**0.9164**

1) Chest-14 dataset: > 112,000 images
2) Fast growing direction of science
3) ChesXNet ~ Densenet-121 trained on the Chest-14 dataset

Data augmentation - GANs
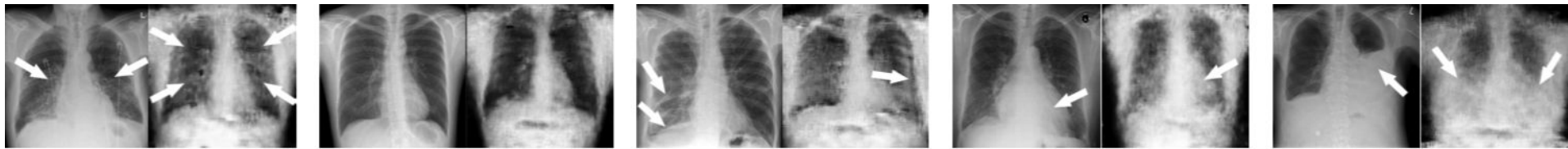
- Claimed to improve classification accuracy

Pathologies detection: RSNA Kaggle competition
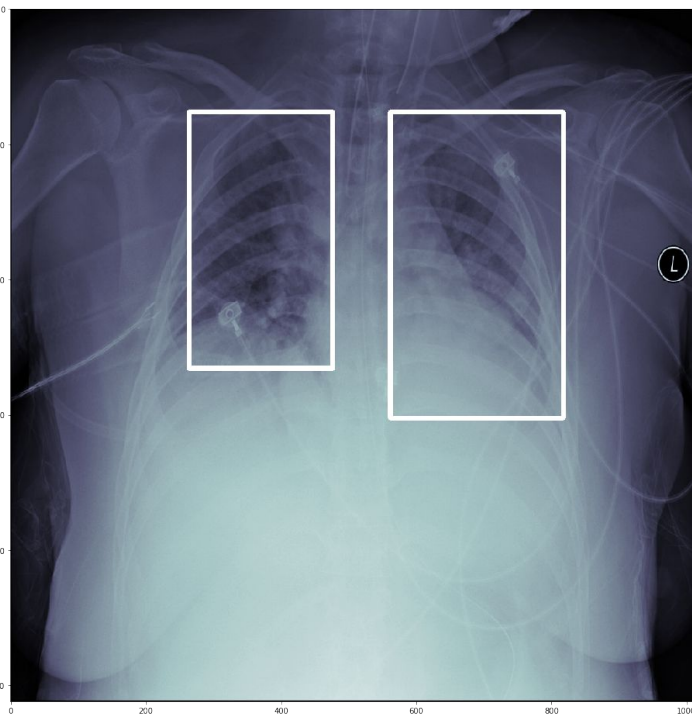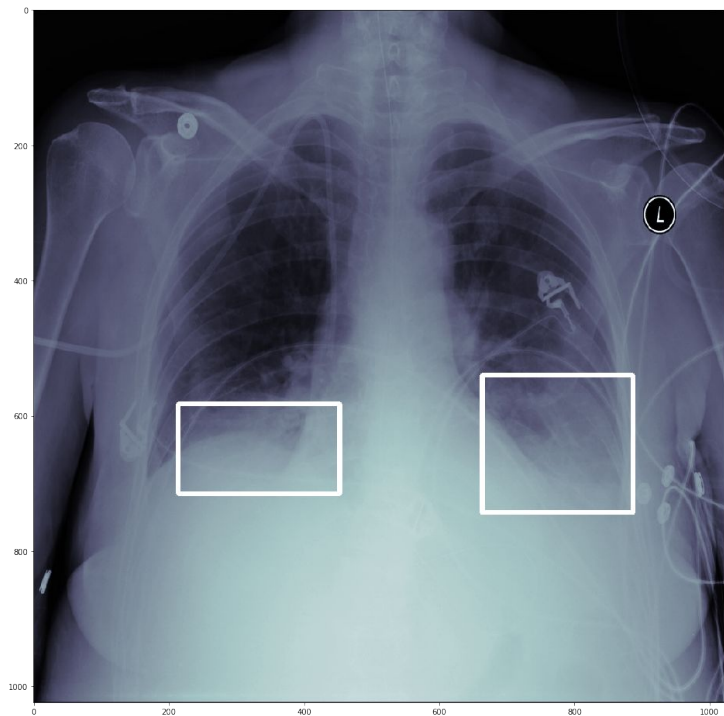
*RCNN family

*U-net family

Personnel

1. **Bulat Ibragimov - science head of the lab.**

   8 years experience, h-index:10

   Postdoc, Xing Laboratory, Stanford University, Stanford, USA

   Postdoc, Laboratory of Imaging Technologies, University of Ljubljana, Slovenia

2. **Ramil Kuleev - supervisor of the lab**

   > 10 years experience

   Project manager, Innopolis, Russia

   Research data scientist in medical image processing lab, Innopolis, Russia

3. **Ilyas Sirazitdinov - research data scientist**

   1.5 years experience

   Intern data scientist in medical image processing lab, Innopolis, Russia

   Master degree, Innopolis, Russia

4. **Maksim Kholyavchenko - research data scientist**

   1.5 years experience

   Intern data scientist in medical image processing lab, Innopolis, Russia

   Bachelor degree, Innopolis, Russia

Previous work

1. Advanced approaches to computer-aided detection of thoracic diseases on chest X-rays
   AN Zakirov, RF Kuleev, AS Timoshenko, AV Vladimirov
   Applied Mathematical Sciences 9 (88), 4361-4369

2. On a new approach to the automated detection of thoracic organs diseases using the spot feature in the analysis of digital X-ray images
   SB Belhaouair, RF Kuleev
   Applied Mathematical Sciences 8 (164), 8171-8177

3. A game-theoretic framework for landmark-based image segmentation
   B Ibragimov, B Likar, F Pernus
   IEEE Transactions on Medical Imaging 31 (9), 1761-1776

4. Learning Deconvolutional Deep Neural Network for High Resolution Medical Image Reconstruction
   H Liu, J Xu, Y Wu, Q Guo, B Ibragimov, L Xing
   Information Sciences

What we offer:

- **Interesting projects**
- Large datasets
- Computational resources
- Careful supervision
- Collaborative work under projects and papers
- Summer internship

Options to work with us:

Beginners,middle-level and experienced students:

● Kaggle in-class is coming soon!

   1) Images classification task
   2) Don't be sad if you fail. Please, download your kernel to Kaggle or send us directly, we will take a look. Your approach and the way you think is much more important than the unexplainable solution.

Experienced or brave students:

● You are welcome to join RSNA Pneumonia detection Kaggle challenge.
   The competition's deadline: middle of October.

Contact: @ilyas_sid
Questions?

Thank you for attention :)