



**THERAPIXEL**  
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# Deep Learning for human level AI in radiology

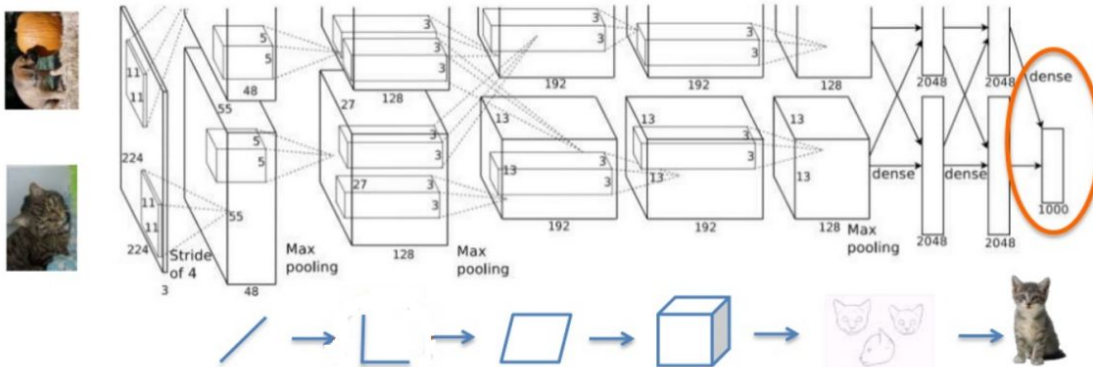
October 14th, 2020

Teratec AI-HPC

by Yaroslav Nikulin @ Therapixel AI team

# Deep Learning (r)evolution

## AlexNet (Krizhevsky et al. 2012)



- incremental research improvements + GPGPU
- Neural Net - a smooth differentiable object connecting input and output
- phase transition for several problems = human level perf

BUT:

- usually needs a lot of problem-specific (!) data
- still demands a lot of work of highly skilled programmers
- AND specialists from the target domain
- for a qualitatively new data: no guarantees you get your solution in X time.

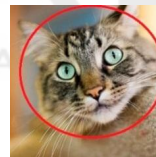
DL = internal combustion engine, specific model = car/truck



In our approach, limited by several factors. Actually 3-5 times higher

- Resolution: 1200x800 vs 224x224
- Zone of Interest : < 1% vs > 50%
- Number of classes : 2 vs 1000
- Highly imbalanced vs roughly balanced
- Exact data and problem matter

Zone of Interest



# Examples of emerging DL applications

- Autonomous vehicles : impacts numerous industries
- Chatbots : virtual assistants, low level HR functions
- eCommerce : salesmen, consultants
- Logistics : from Amazon to international cargo hubs management



Image credit: [viatech.com](http://viatech.com)



Image credit: [Image by chuttersnap by Unsplash](https://www.unsplash.com)

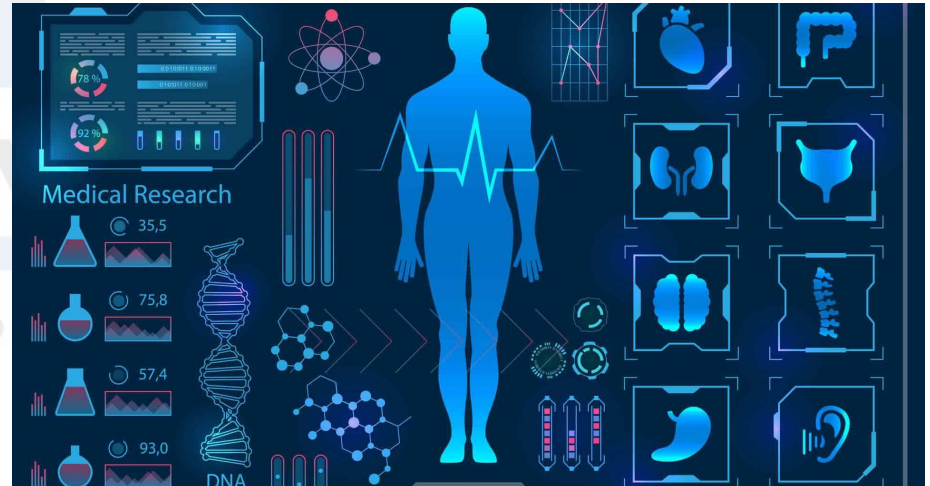


Image credit: [lotus-ga.com](http://lotus-ga.com)

# Therapixel: AI-augmented radiology



2013

Founded



Olivier Clatz,  
PhD



Pierre Fillard,  
PhD

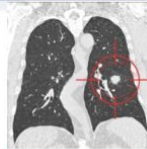
2015

Visualization SW

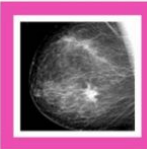
2016

AI research

2017



5<sup>th</sup> place Kaggle Data Bowl



1<sup>st</sup> place DREAM DM

2018

Mamm screen  
Clinical Study  
Therapixel Cloud



2019

MammoScreen  
deployed

2020

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# MammoScreen: virtual radiologist assistant

MAMMOSCREEN  
Patient WKE\_0000558 - 31/12/1899  
Exam Date 01/07/2019

Your current browser is too old. Please upgrade to the latest version.

## HIGH SUSPICION - RIGHT BREAST

Images displayed are not for diagnostic use

**Right Breast Findings:**

- R CC:** Mass & Calcification High susp. (8/10)
- L CC:** Soft tissue lesion Lowest susp. (2/10)
- R MLO:** Mass & Calcification High susp. (8/10), Soft tissue lesion Indeterminate (6/10), Calcification Indeterminate (6/10)
- L MLO:** Soft tissue lesion Lowest susp. (2/10)

Filtering:  More findings

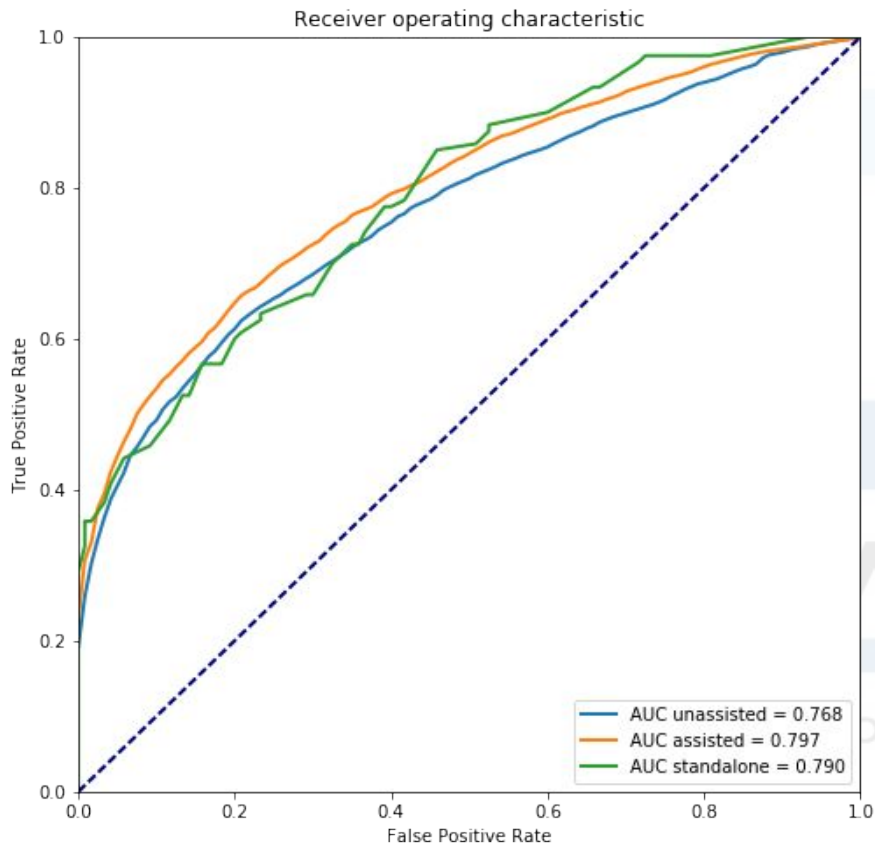
Right breast

Left breast

Show low susp Hide low susp

1 2 3 4 5 6 7 8 9 10

# MammoScreen: clinical study shows human-level performance



- on a difficult dataset enriched in cancer
- 14 radiologists specializing (!) in mammography
- MammoScreen 1.0 = reliable peer for radiologist
- US FDA clearance obtained
- MammoScreen 1.2 further increased performance

# AI needs (cloud) infrastructure: MammoScreen in Production





Thank you for your attention!

Q&A session

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