

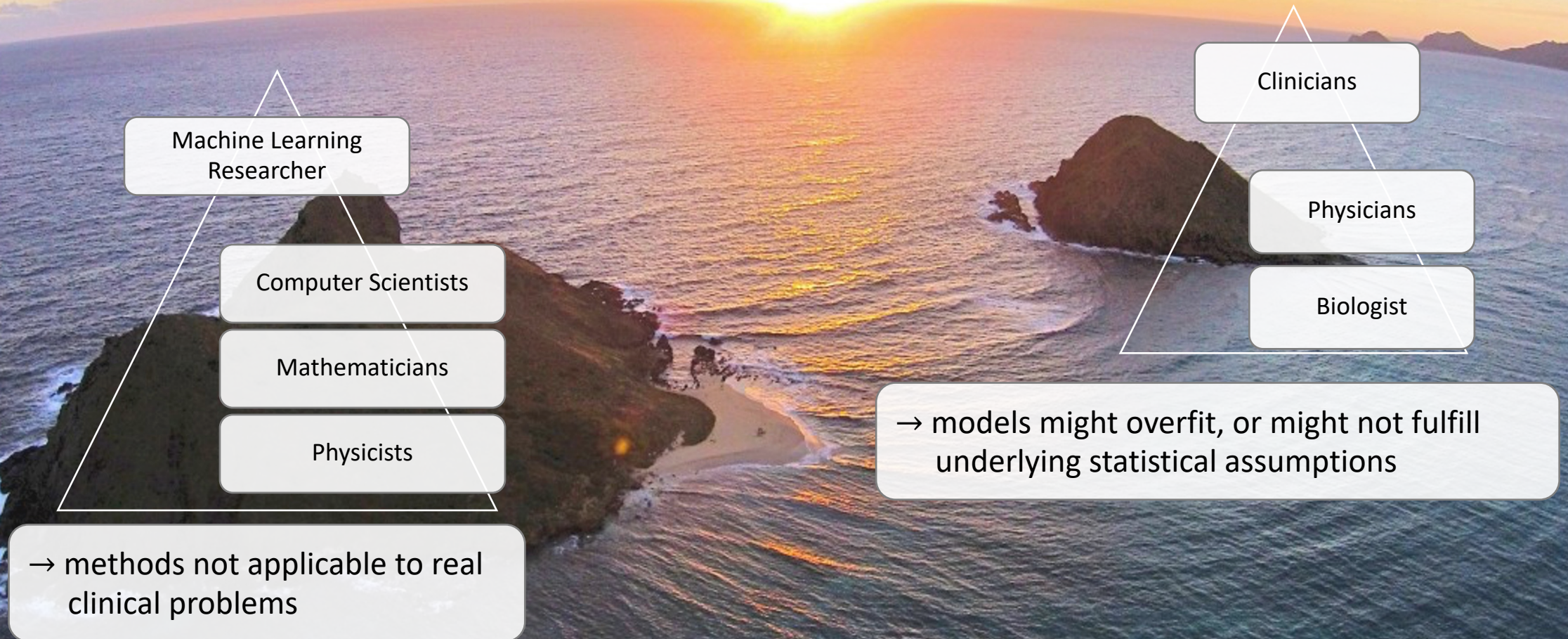


# Clinical Research and Data Science: Bridging the Gap

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Improve patient care with machine learning

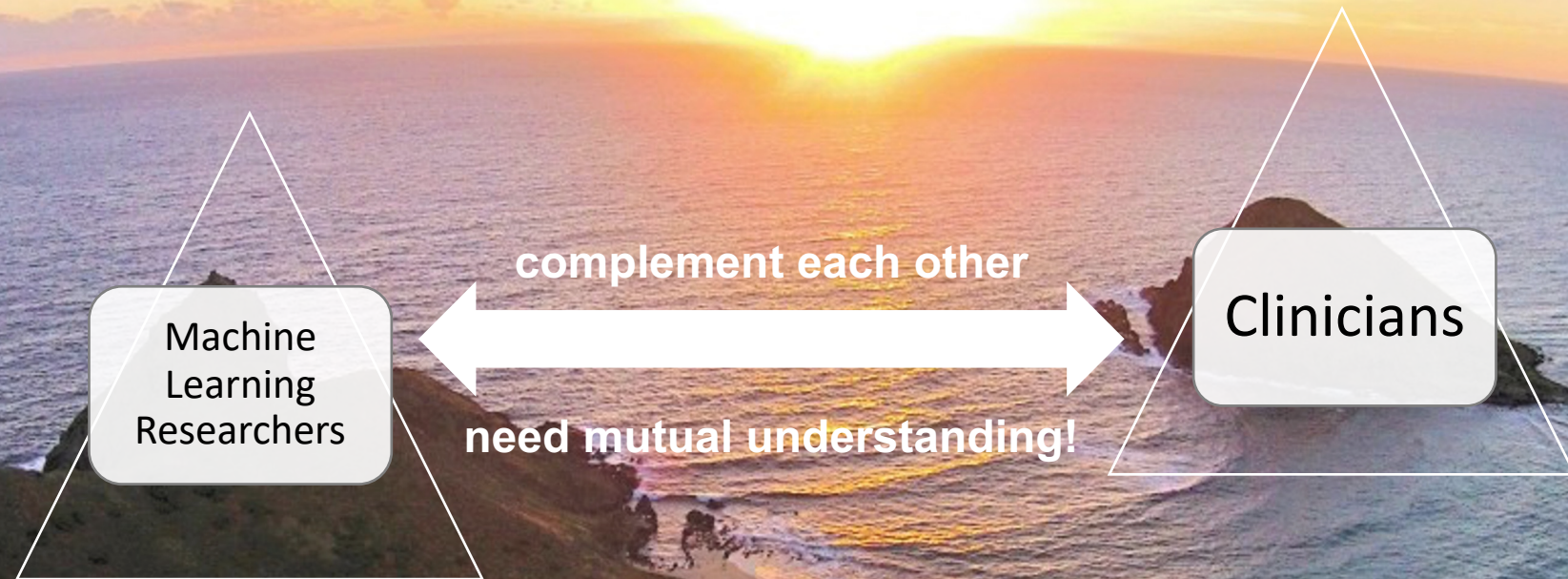
# The Need for Interdisciplinary Collaborations



Picture: [www.dronestagr.am](http://www.dronestagr.am), JimmyWilkinson

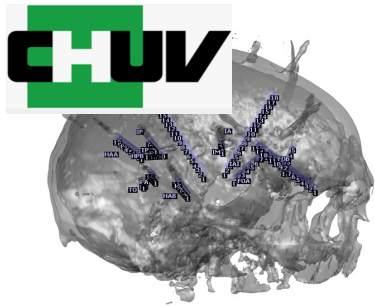
# Closing the Gap

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Picture: [www.dronestagr.am](http://www.dronestagr.am), JimmyWilkinson

# Examples of Clinical Projects



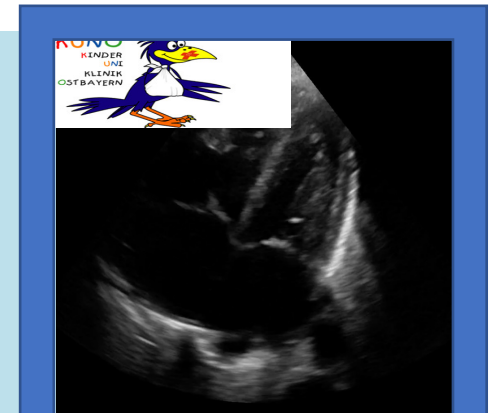
Epilepsy



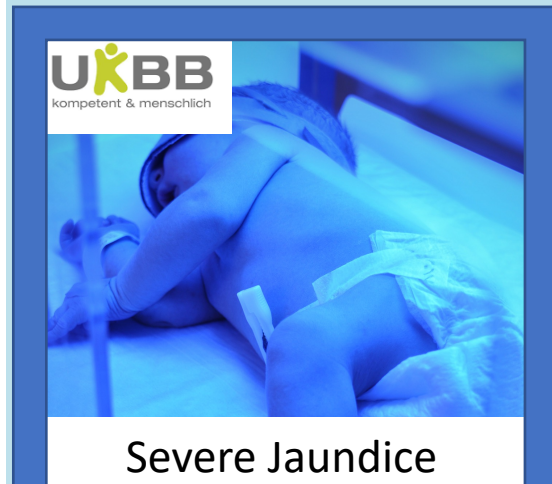
Sepsis (Blood Poisoning)



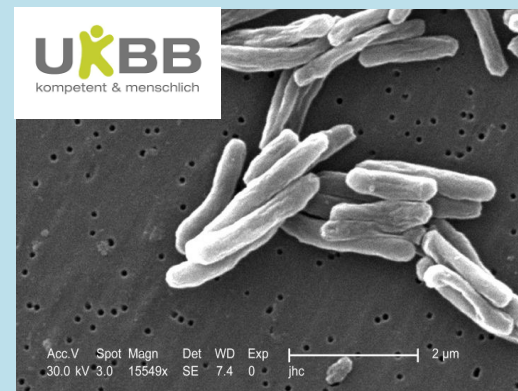
Appendicitis



Heart-Defects



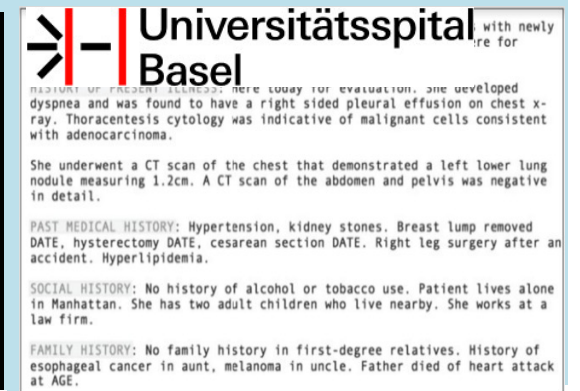
Severe Jaundice



Tuberculosis

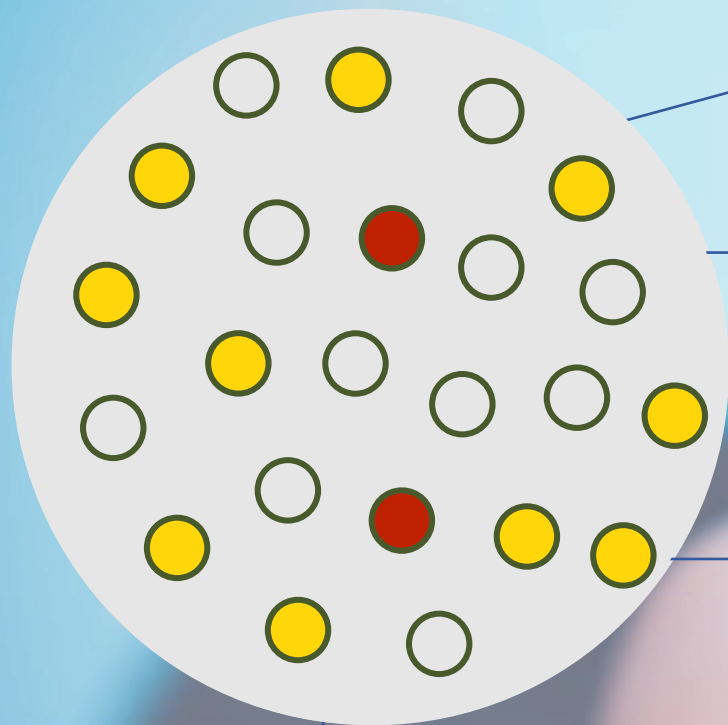


Brain MRI



Electronic Health Records

# Example 1: Personalized Prediction in Neonates



Jaundice due to hyperbilirubinemia is one of the most prevalent medical condition in neonates

60%

newborn babies turn yellow (jaundice, "Gelbsucht")



10%

require treatment (phototherapy)



Can cause major disability with life-long consequences  
Shorter hospitalization has increased critical jaundice

Picture: commons.Wikimedia.org, Janko Ferlič

# Early Prediction of Need for Phototherapy in Neonates

## Phototherapy Prediction

Online tool (prototype):

**Phototherapy Prediction\***

This tool predicts how likely it is that a newborn child will need a phototherapy treatment within 48 hours after a bilirubin measurement.\*\*

**NOTE: For educational purpose only. Practical clinical considerations need to be incorporated.**

Gestational age (in weeks+days, e.g. 37+2)

Hours since birth

Weight (in grams)

Bilirubin (in  $\mu\text{mol/L}$ )

\* This tool is a prototype developed in collaboration with the UKBB Paediatric Pharmacology and Pharmacometrics Research Center. Further information can be found in our [publication](#).  
\*\* With respect to the [phototherapy initiation guidelines of the UKBB](#).

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82.7 % probability that the child should get a phototherapy within the next 48 hours, with respect to the guidelines of the UKBB.

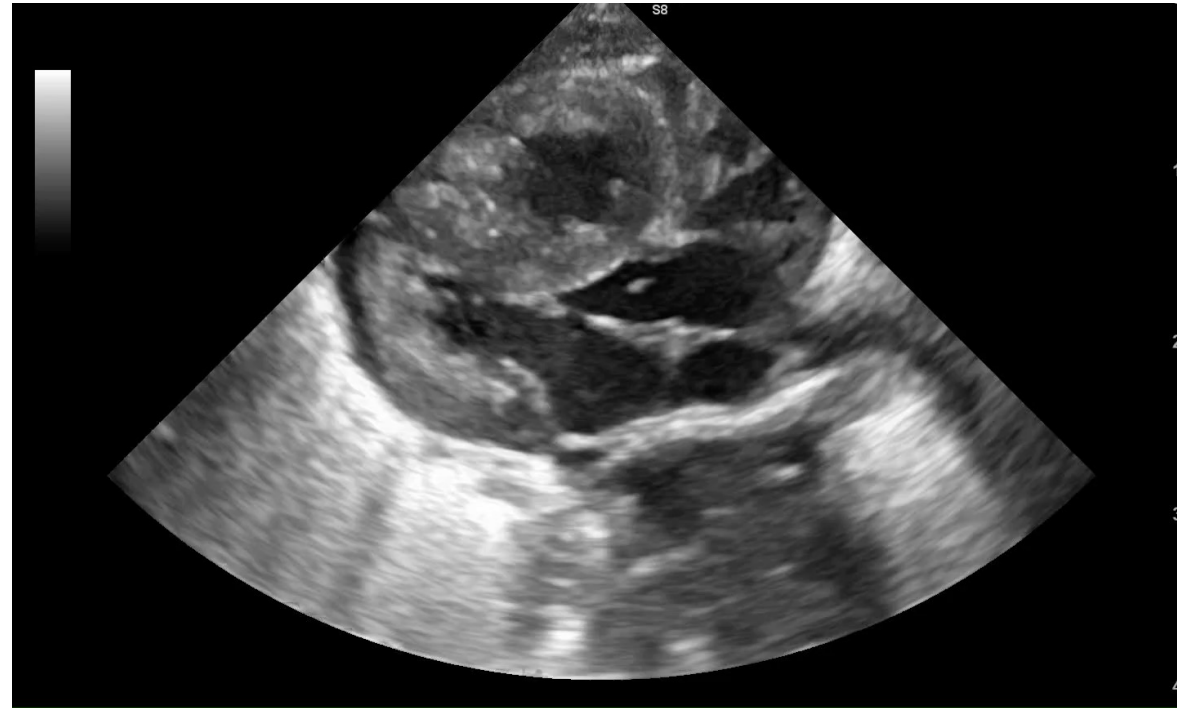
ML model for the personalized prediction of severe jaundice

Early prediction up to 48h in advance

Strong predictive performance

Variable Selection: only 4 variables suffice

# Example 2: Detecting Heart Defects in Newborns



# Heart Echo Data Set (5 different views)

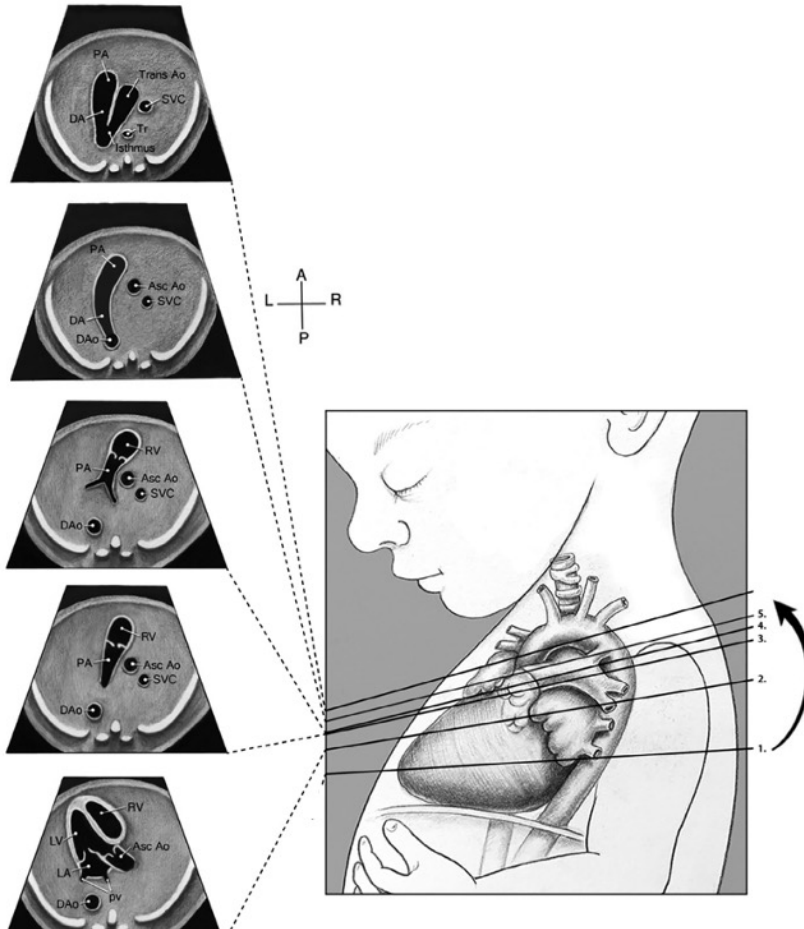
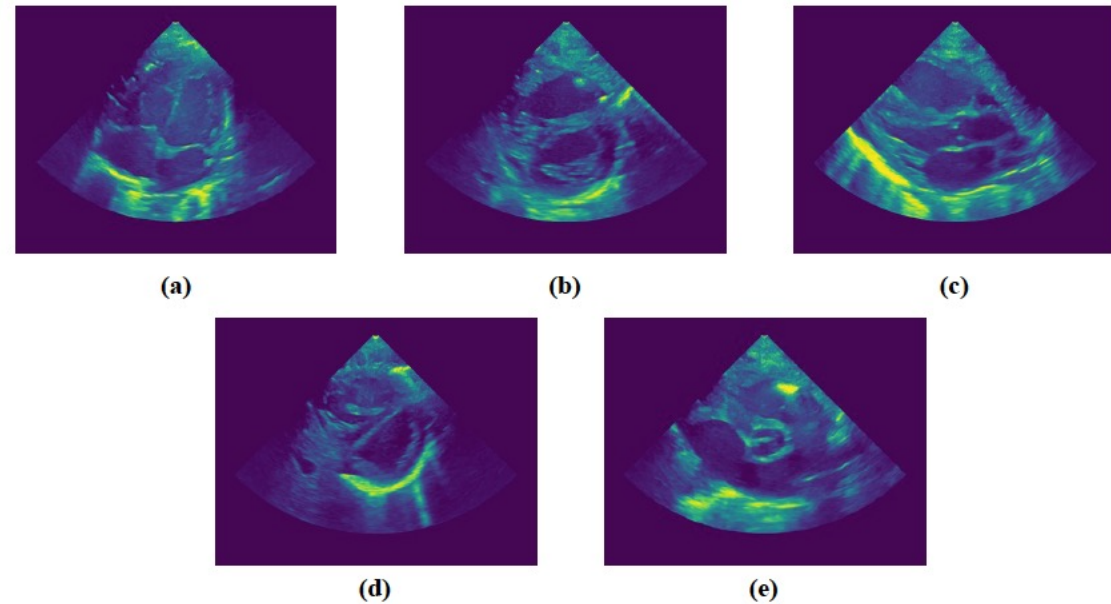
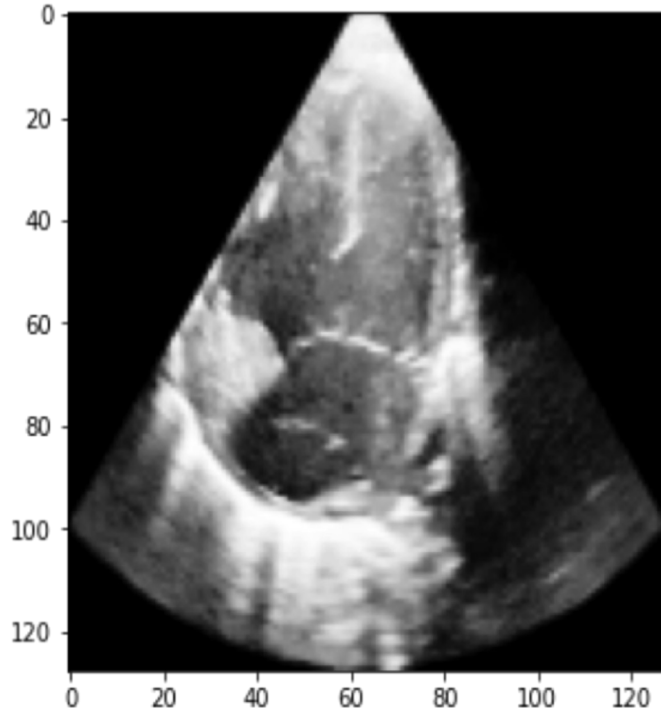


Image: obgynkey.com



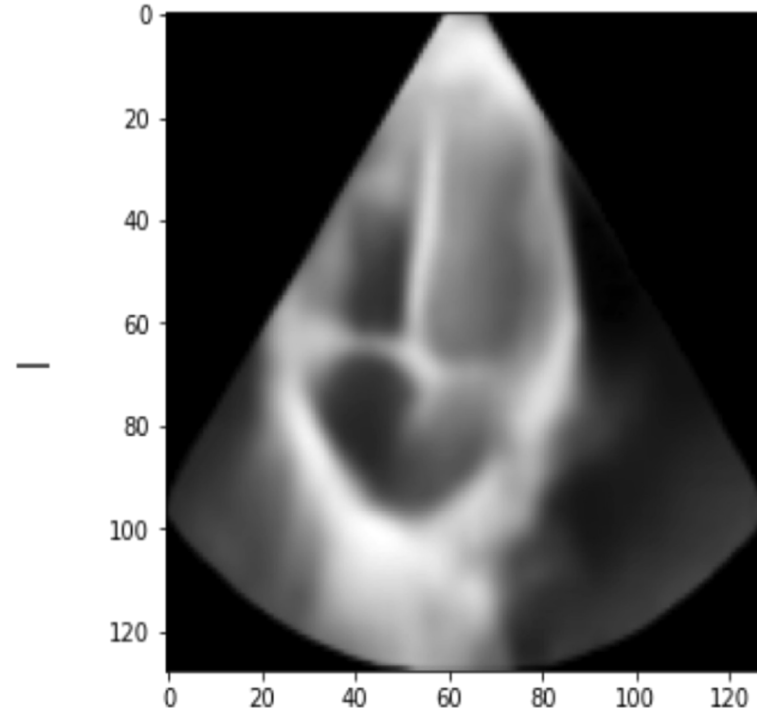
# Anomaly Detection

$X$



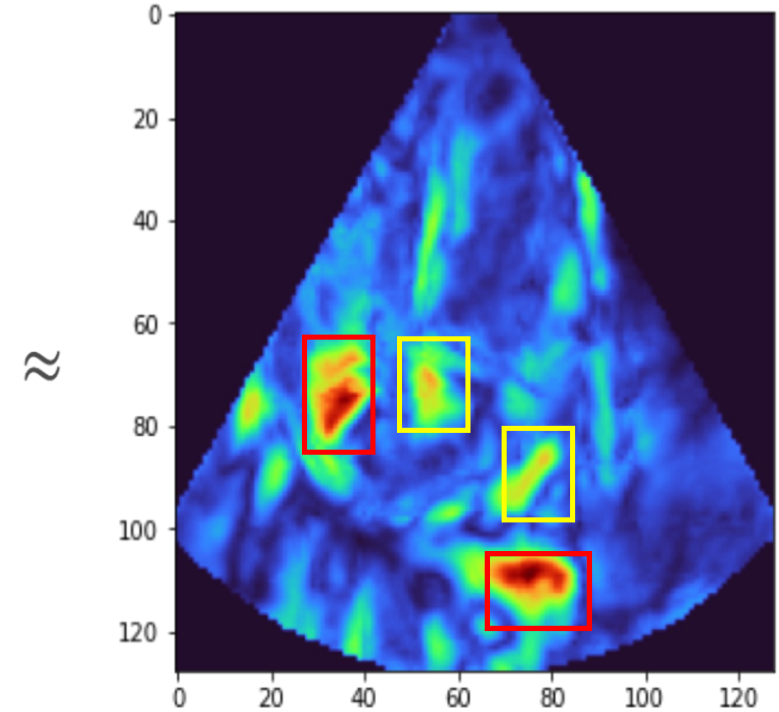
Ultrasound image

$X_{reconstructed}$



Reconstructed healthy heart

$Anomalies$



Visualization of the differences

# Bridging the Gap: Challenges and Chances

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- Data Access & Availability
- Legal Agreements
- Ethics & Privacy
- Research Cultures
- Infrastructures



- Early Prediction/ Intervention
- Personalized Care
- Improved Diagnosis
- Enhanced Treatment
- Decision Support Tools

Challenges

Chances