ETH zürich

D-INFK

Clinical Research and Data Science: Bridging the Gap

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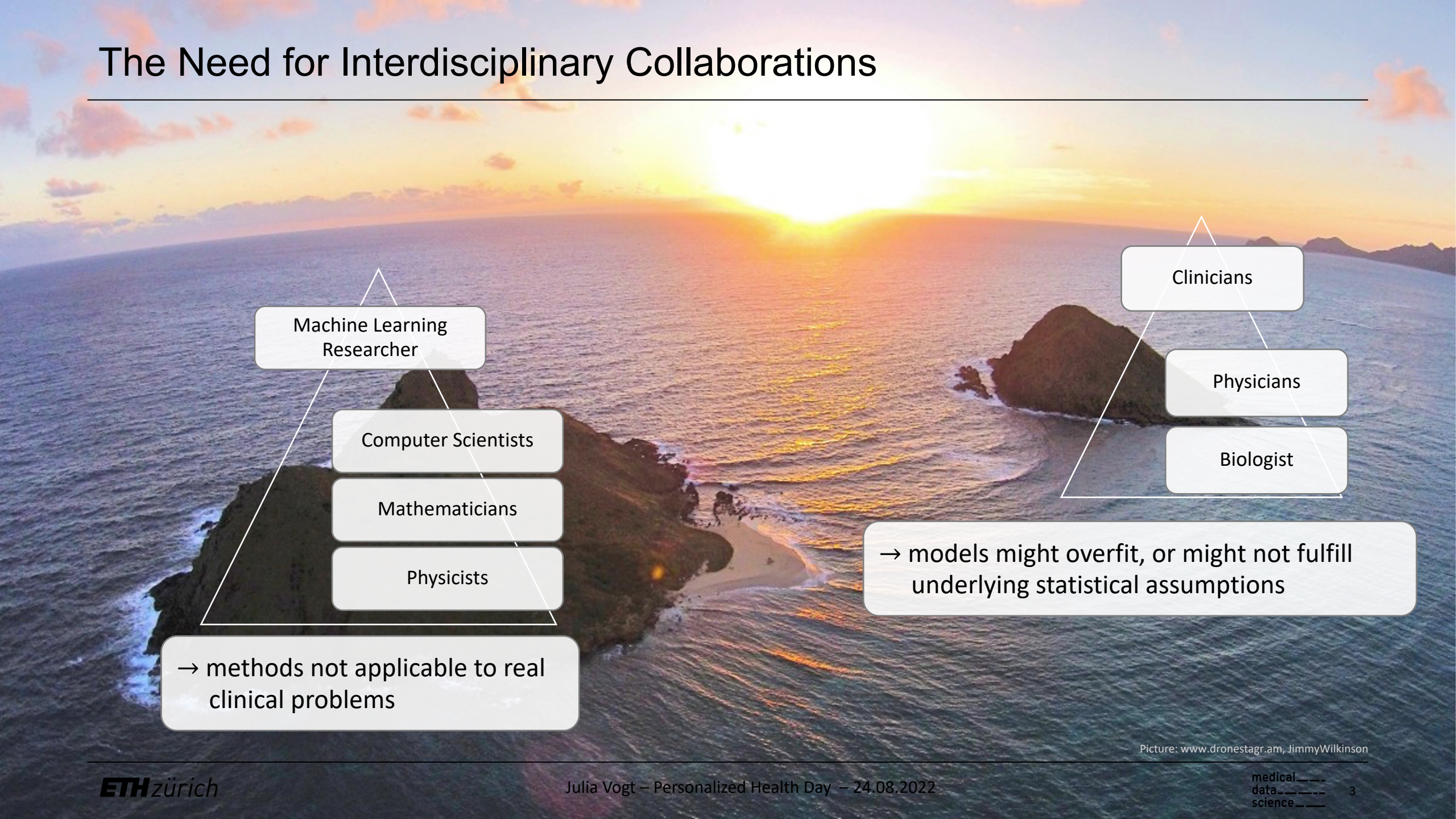
medical data science

High Level Goal

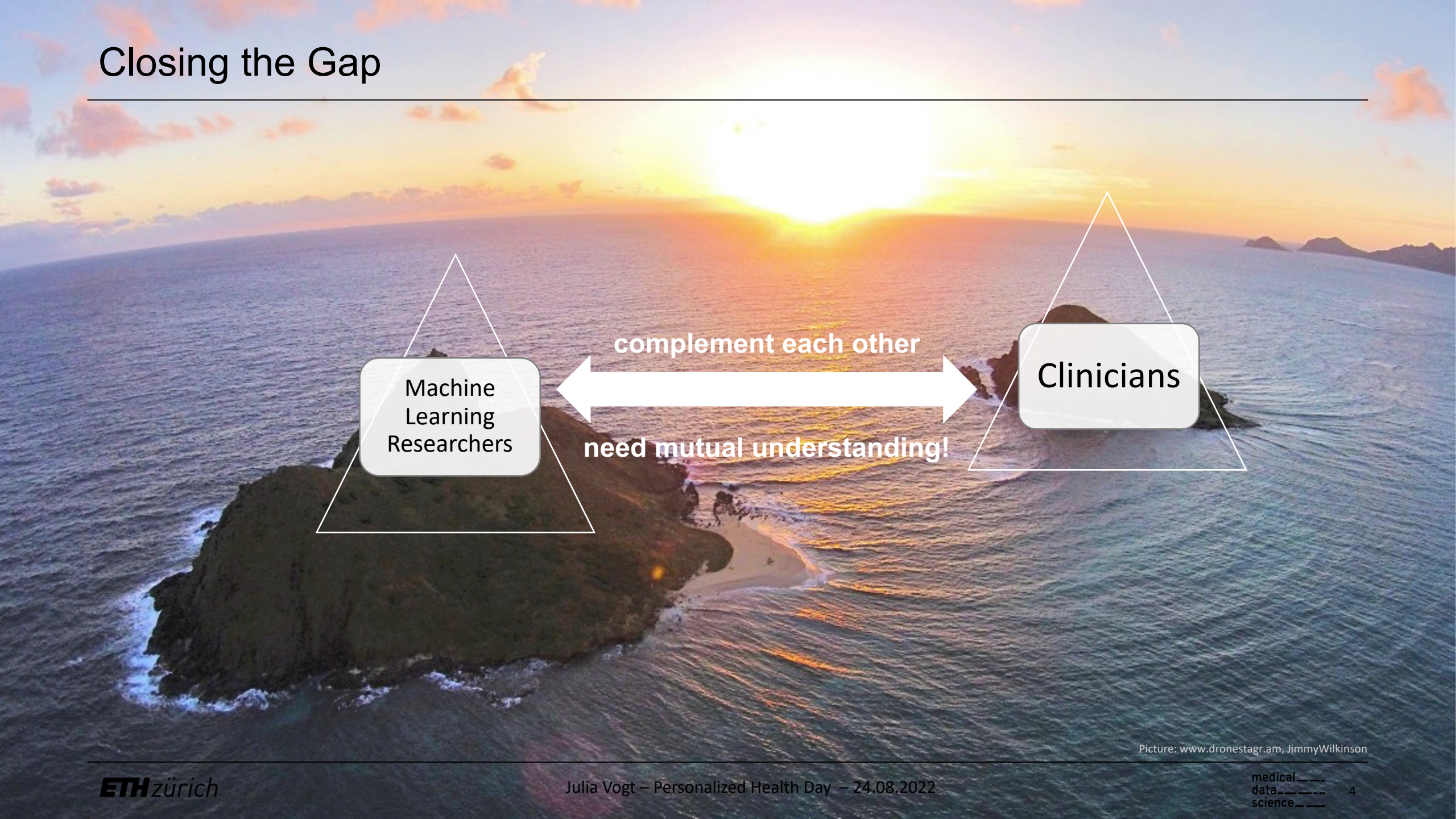
Improve patient care with machine learning

The Need for Interdisciplinary Collaborations



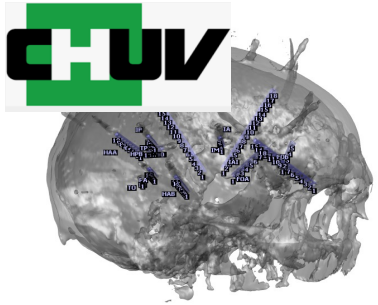
Picture: www.dronestagr.am, JimmyWilkinson

Closing the Gap



Picture: www.dronestagr.am, JimmyWilkinson

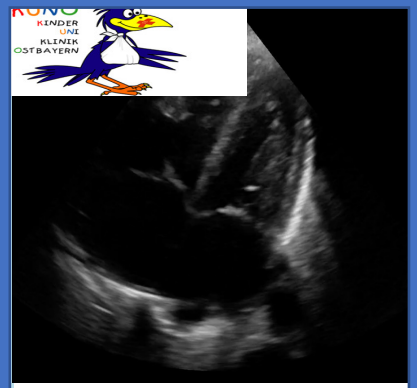
Examples of Clinical Projects



Epilepsy

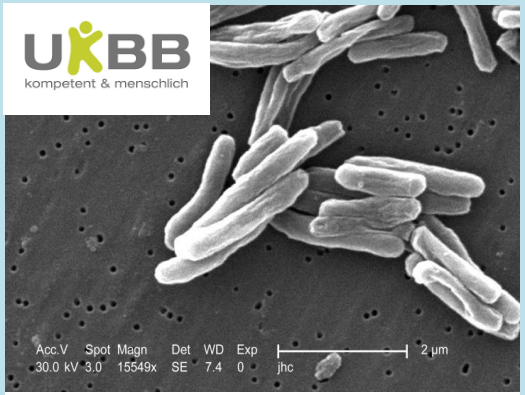
Sepsis (Blood Poisoning)

Appendicitis



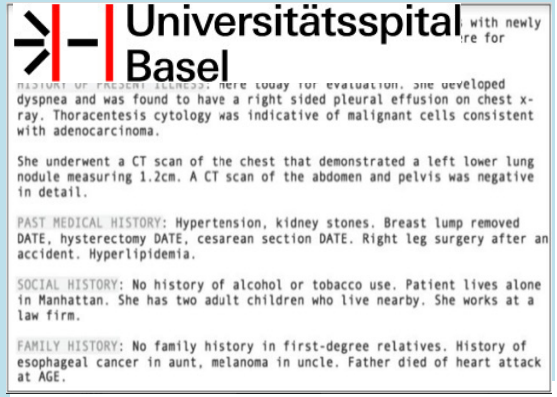
Heart-Defects

Severe Jaundice



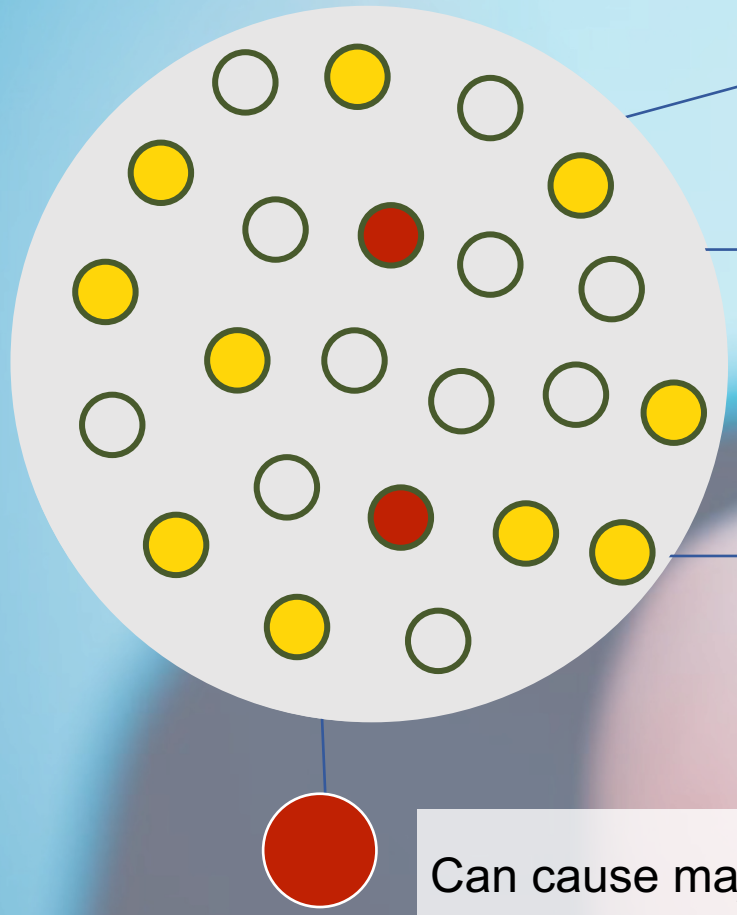
Tuberculosis

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

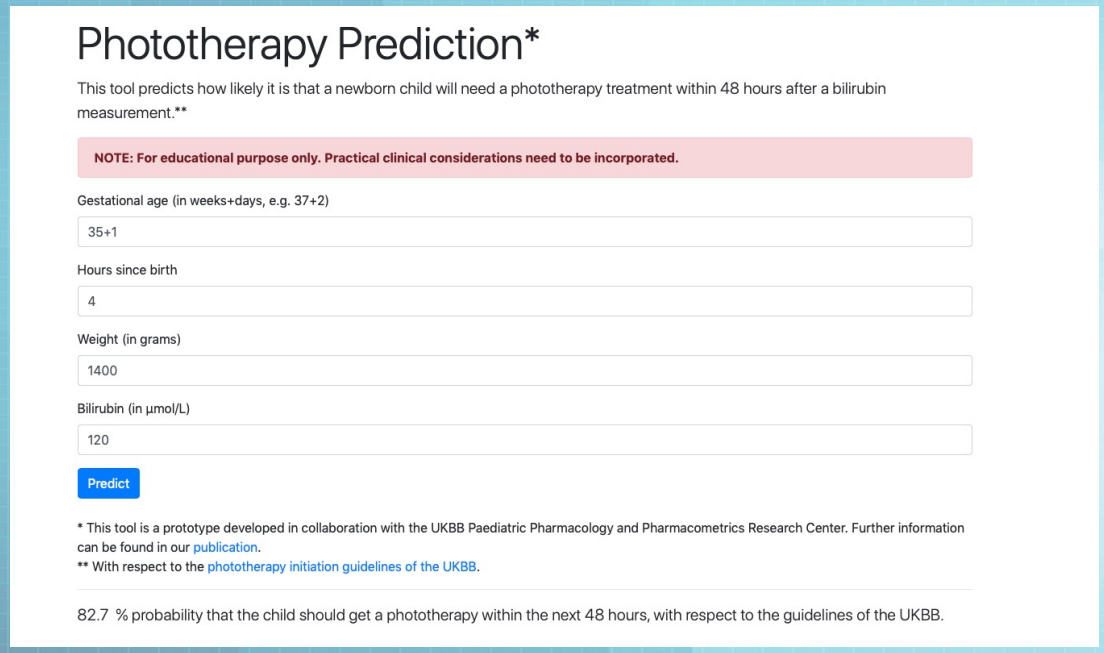
Shorter hospitalization has increased critical jaundice

Picture: commons.Wikimedia.org, Janko Ferlič

Early Prediction of Need for Phototherapy in Neonates

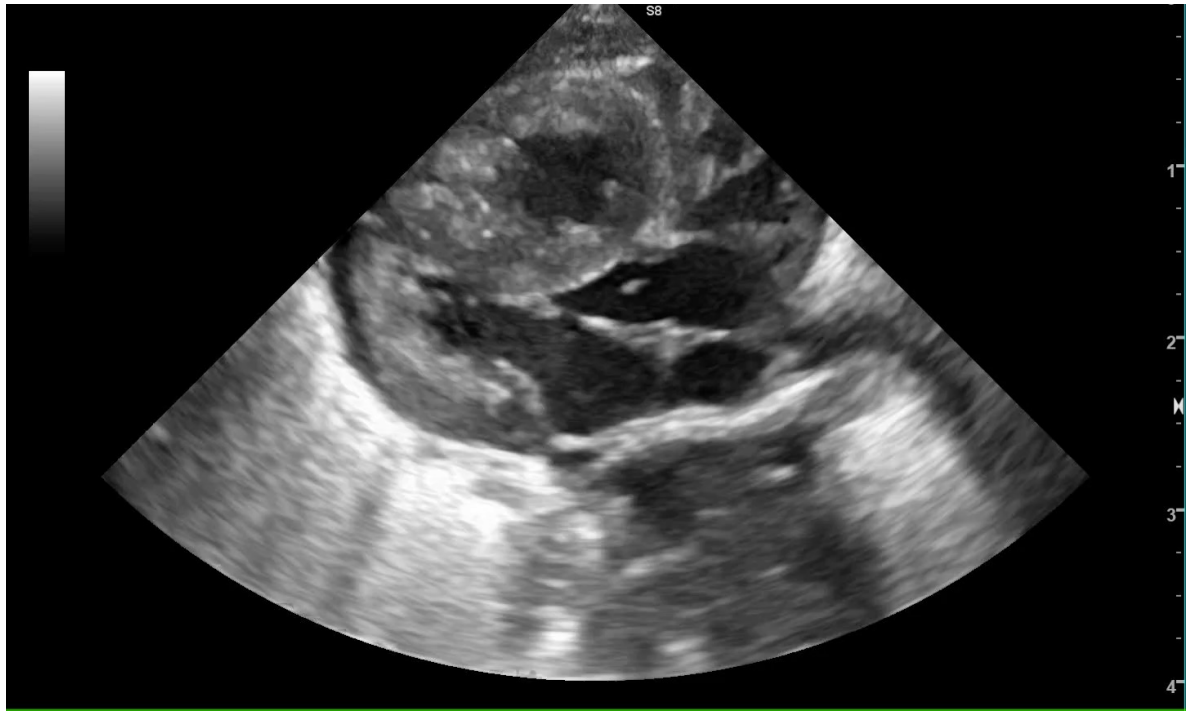
Phototherapy Prediction

Online tool (prototype):

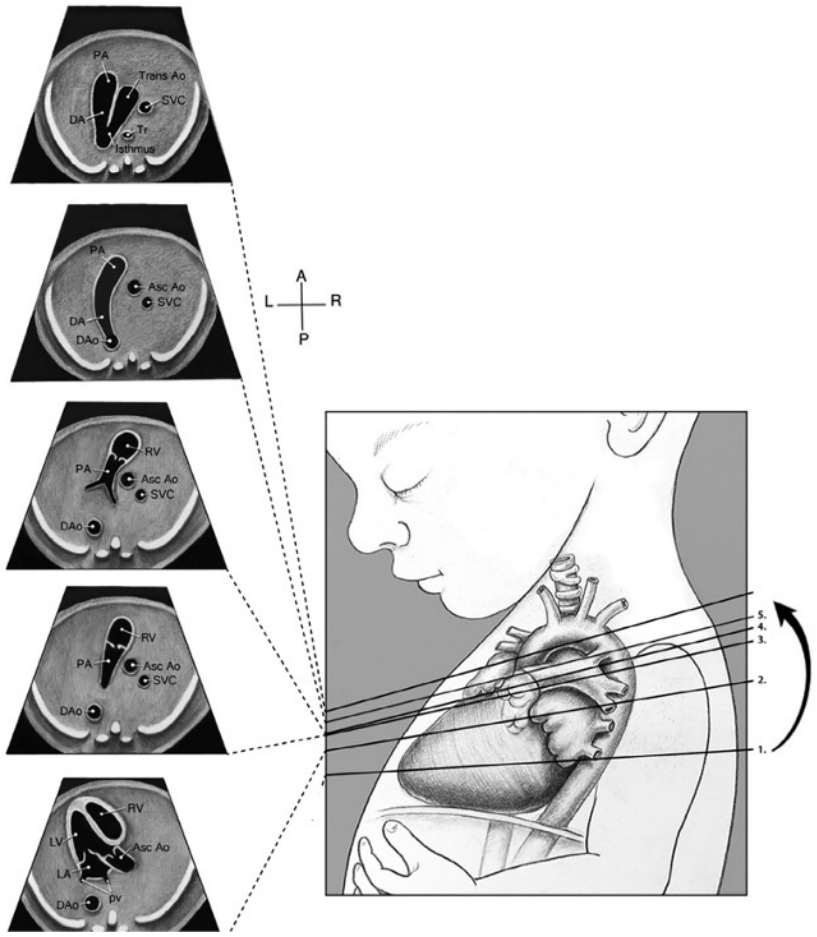


- ML model for the personalized prediction of severe jaundice
- Early prediction up to 48h in advance
- Strong predictive performance
- Variable Selection: only 4 variables suffice

Example 2: Detecting Heart Defects in Newborns



Heart Echo Data Set (5 different views)



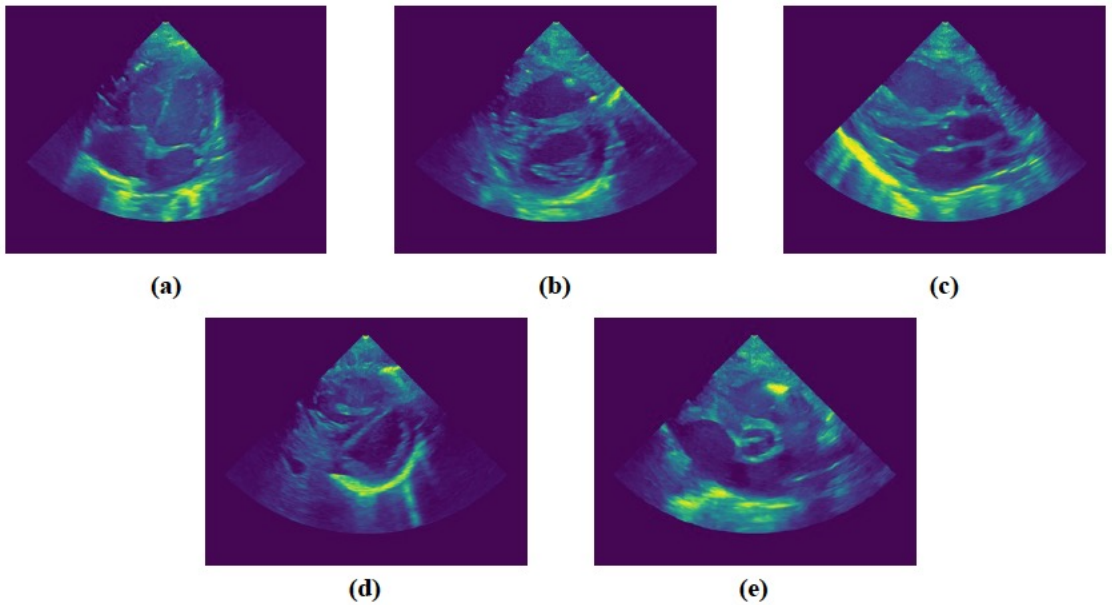
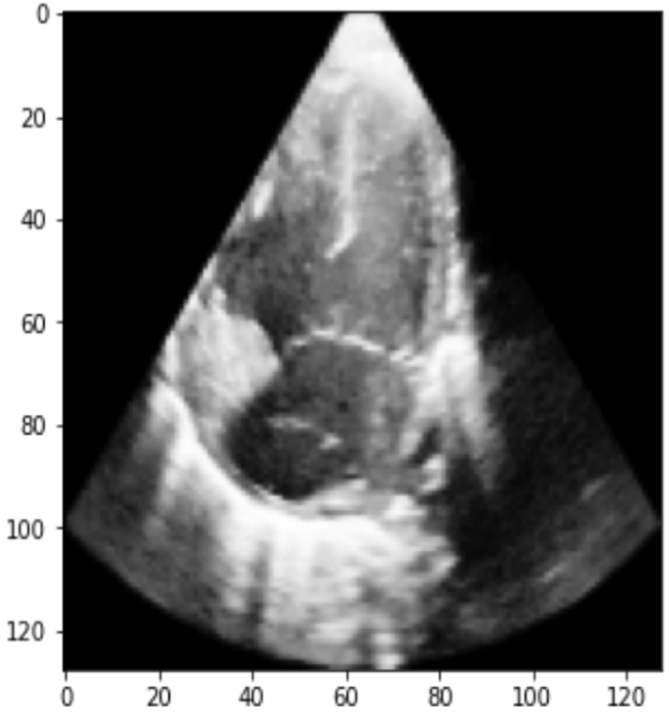


Image: obgynkey.com

Anomaly Detection

X



Ultrasound image

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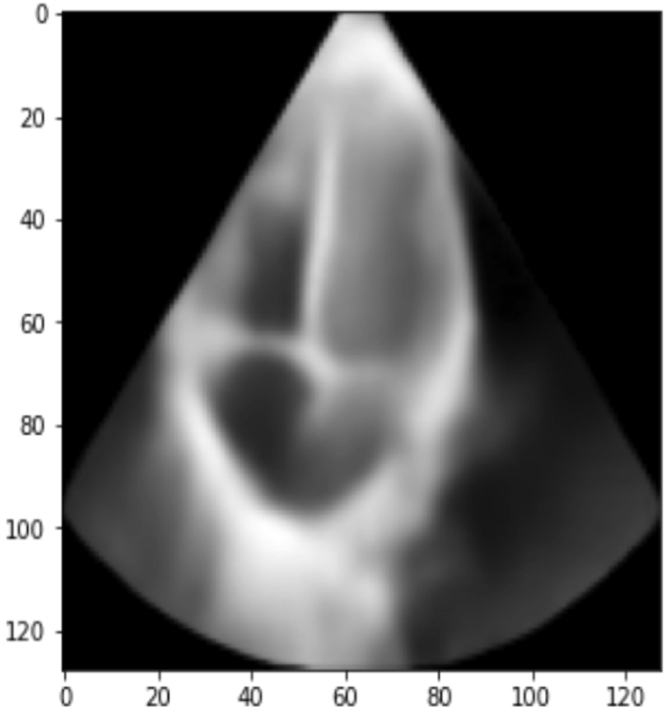
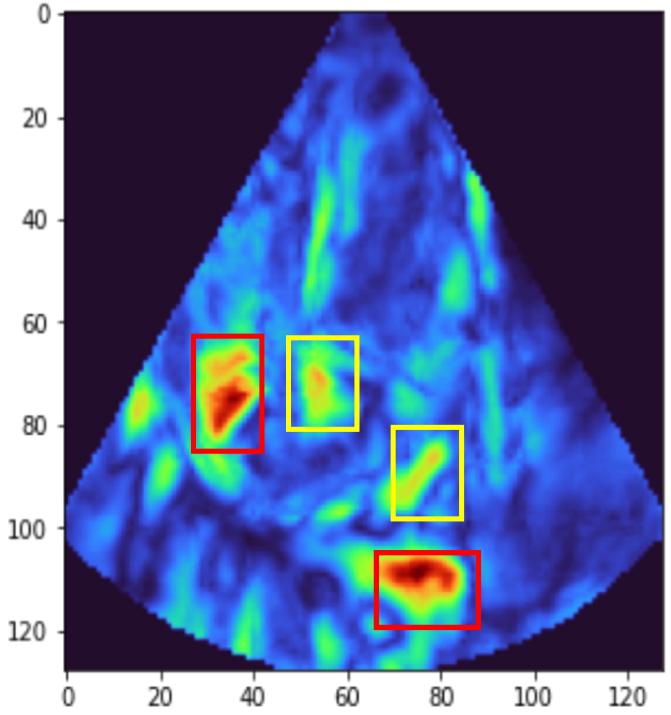
$X_{reconstructed}$



Reconstructed healthy heart

$\approx$

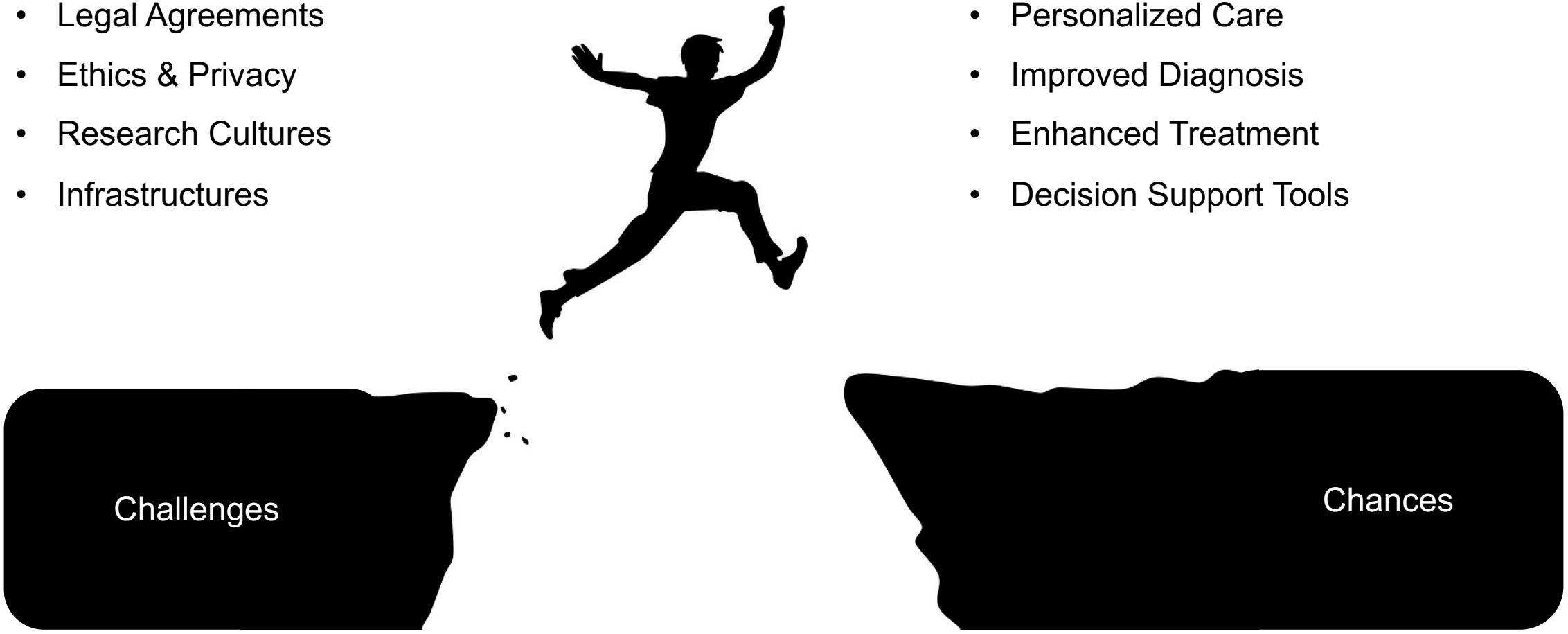
$Anomalies$



Visualization of the differences

Bridging the Gap: Challenges and Chances

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



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