# Machine learning for improving healthcare decisions in disadvantaged areas

Prof. Dr. Alexandre Chiavegatto Filho



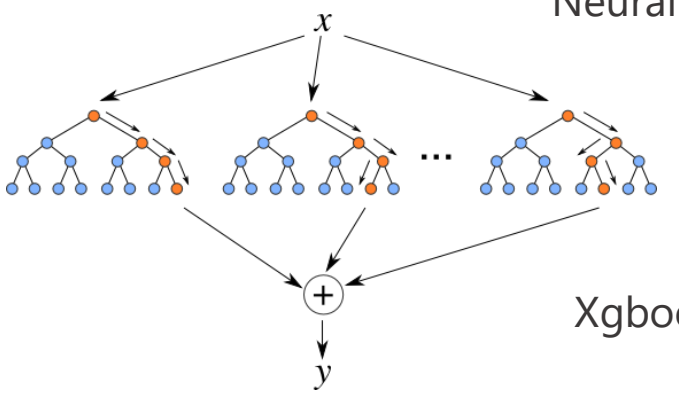
# MACHINE LEARNING

Practical problems, usually for predicion (decision making)

Complex decisions in healthcare.

Free to model the real complexity of the world.

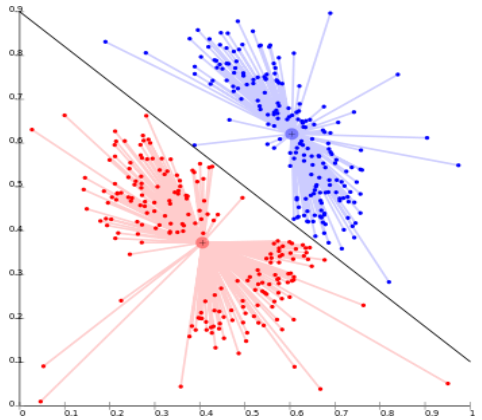
Neural networks

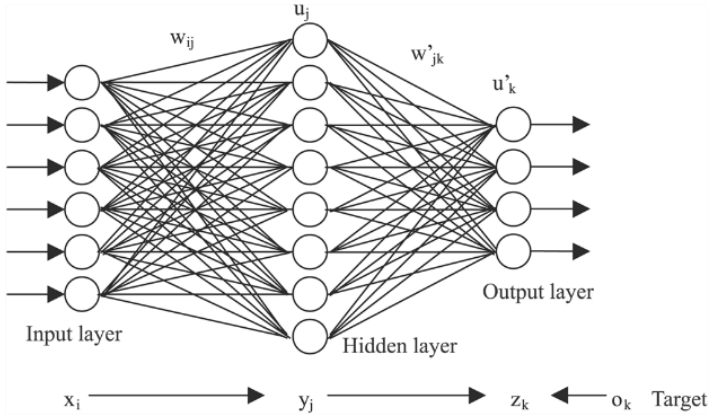



K-means

Xgboost

Random forests



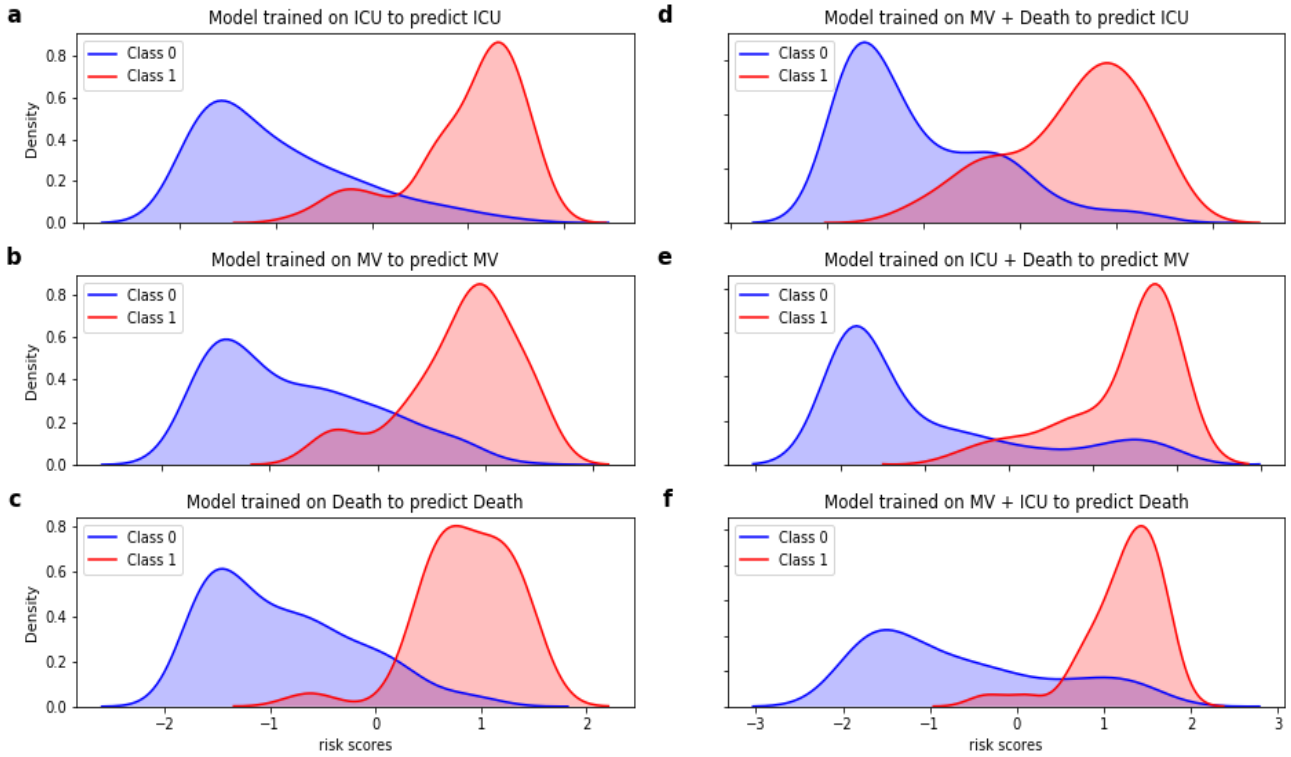



Penalized regressions

# A multipurpose machine learning approach to predict COVID-19 negative prognosis in São Paulo, Brazil

Fernandes FT, Oliveira TA, Teixeira CE, Batista AFM, Costa GD, Chiavegatto Filho ADP.

Scientific Reports 2021; 11, 3343.

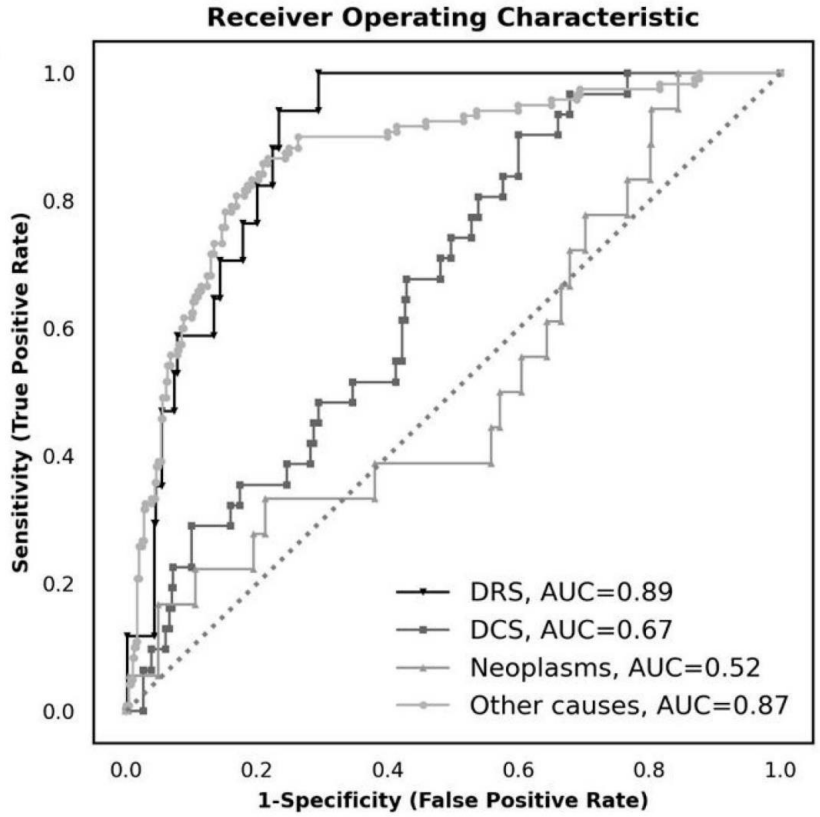



- 1,040 patients with covid-19 at a hospital in São Paulo.
- Development of multipurpose algorithms.
- All models, even those trained with different outcomes, showed high predictive performance, with an AUC-ROC above 0.91.
- Difference between aggregated and individual models within the 95%CI.

# Cause-specific mortality prediction in older residents of São Paulo, Brazil: a machine learning approach

Nascimento CF, Santos HG, Batista AFM, Lay AAR, Duarte YAO, Chiavegatto Filho ADP

Age and Ageing 2021;50(5)

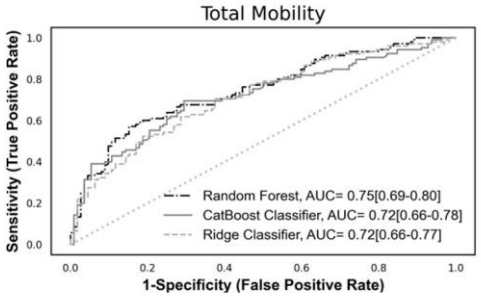


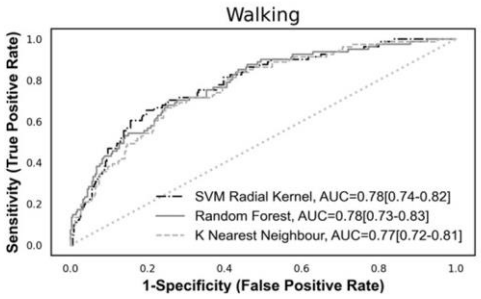

- Data from a representative sample of older residents of São Paulo, Brazil.
- Predict cause-specific mortality within 5 years.
- Highest predictive performance was for death by DRS (AUC−ROC = 0.89), followed by the other specific causes (AUC−ROC = 0.87), DCS (AUC−ROC = 0.67) and neoplasms (AUC−ROC = 0.52).
- Among only the 25% of individuals with the highest predicted risk of mortality from DRS were included 100% of the actual cases.

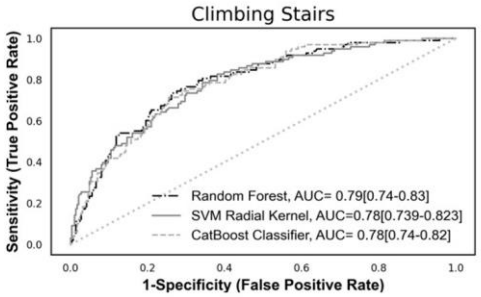
# Early identification of older individuals at risk of mobility decline with machine learning

Nascimento CF, Batista AFM, Lay AAR, Duarte YAO, Chiavegatto Filho ADP

Archives of Gerontology and Geriatrics 2022




- Evaluate the predictive performance of machine learning (ML) algorithms in identifying individuals at risk of mobility decline.
- Data from the SABE Study (Health, Well-being and Aging Study).
- Mobility decline was assessed 5 years after admission.
- The tasks that the algorithm was able to predict with better performance were crouching and kneeling (AUC-ROC: 0.81), and lifting or carrying weights (AUC-ROC: 0.80).
- The specific tasks presented higher results than the composite mobility outcome
    - Suggesting that performing separate predictions for each task could lead to improved results.

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Support

FAPESP CNPq

fundação lemann

Microsoft

Main goal:

- Help to improve healthcare decisions, especially in disadvantaged areas.

Two main challenges:

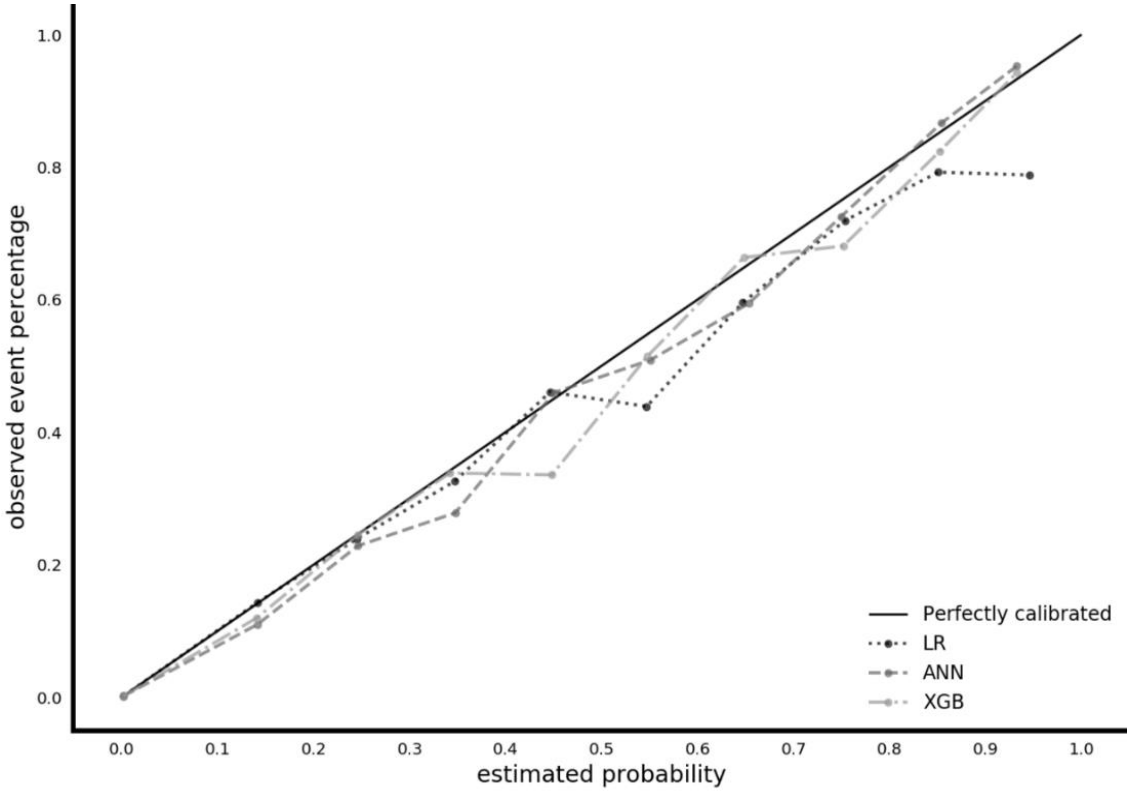
- Lower number of variables collected in disadvantaged areas.

- How to make the algorithms available in disadvantaged areas (no EMR in most cases – only paper records).

# Neonatal mortality prediction with routinely collected data

Batista AFM, Diniz CSG, Bonilha EA, Kawachi I, Chiavegatto Filho ADP.

BMC Pediatrics 2021;21(32)




- Predict neonatal mortality risk (up to 28 days) using linkage data from live births and deaths in the city of São Paulo.

- 2012 to 2017 (1,202,843 births and 7,282 neonatal deaths).

- Predictors: routinely given by SINASC.

- AUC: 0.97 (even with the 5 WHO minimum variables: 0.91).

- 5% higher risk: 90% of all cases.


Support

Microsoft

- RandomIA: digital app to perform randomized controlled trials.

  1 - How to provide the predictions in disadvantaged areas.

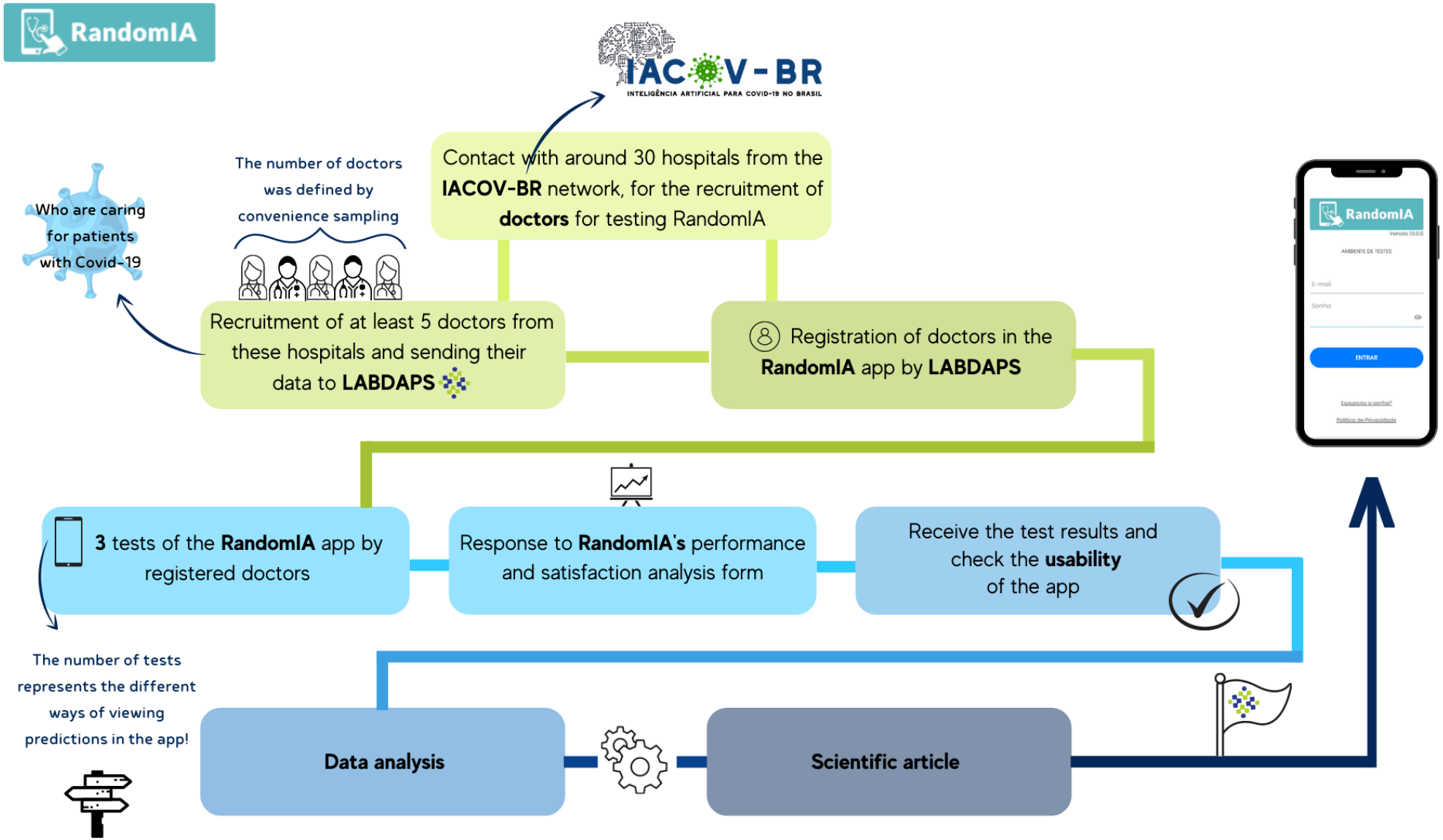
  2 - Machine learning algorithms work in research settings, but do they work in clinical practice?

  - Start with covid-19 diagnosis and prognosis and then move to other diseases.

    - Start date: October, 2021.

    - End date: March 2022.

- First (current) phase: evaluate the usability of the RandomIA app.




# Machine learning for the prediction of tooth loss

PLOS ONE

RESEARCH ARTICLE

## Predictors of tooth loss: A machine learning approach

**Hawazin W. Elani[1,2]*, André F. M. Batista[3], W. Murray Thomson[4], Ichiro Kawachi[5], Alexandre D. P. Chiavegatto Filho[3]**


Machine learning for the prediction of tooth loss

Use multinational diverse longitudinal data from Brazil, Japan, New Zealand, and the U.S. to generate predictive models of tooth loss for adults.

Funding:

HARVARD
School of Dental Medicine

HSDM Internal Grants' Selection Committee


Early prediction of Life's Simple 7® in children and adolescents – A Multicenter South American Study

- Develop machine learning algorithms to predict the Double Burden of Malnutrition.
- We will analyze a sample data of multi-ethnic South American (South American Youth/Child cARdiovascular and Environmental Study SAYCARE) children and adolescents (3 to 18 years).

UTHealth
The University of Texas Health Science Center at Houston
School of Public Health

MICHAEL & SUSAN DELL CENTER *for* HEALTHY LIVING

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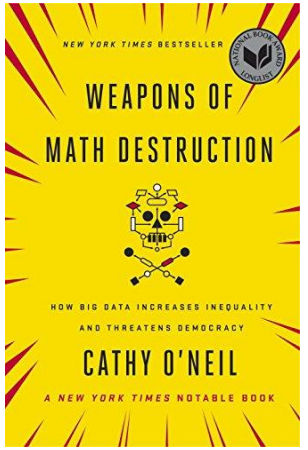
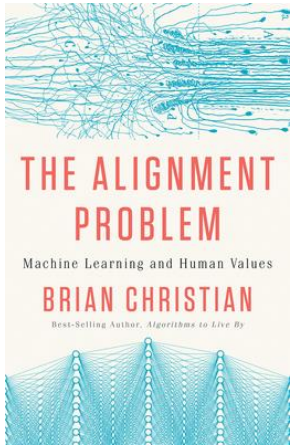
New technical challenges in machine learning for healthcare

- Identifying fairness issues in machine learning algorithms.
- How to correct this issues.




MIT News
ON CAMPUS AND AROUND THE WORLD

## Injecting fairness into machine-learning models

A new technique boosts models' ability to reduce bias, even if the dataset used to train the model is unbalanced.

Adam Zewe | MIT News Office
March 1, 2022

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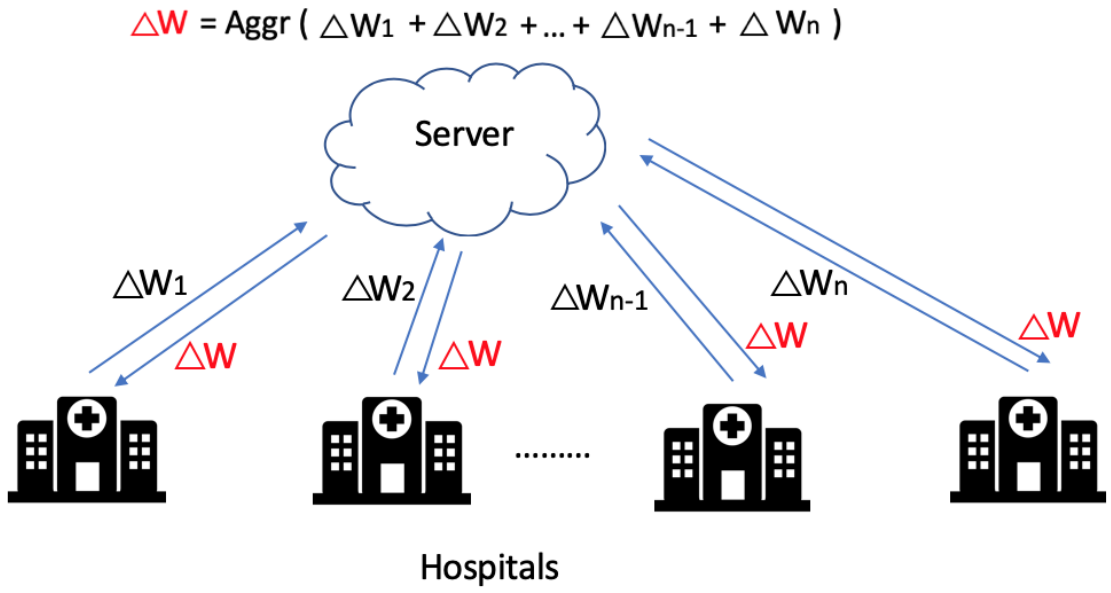
New technical challenges in machine learning for healthcare

Federated learning:

- How to guarantee patient privacy.
- Move the algorithms, not the data.



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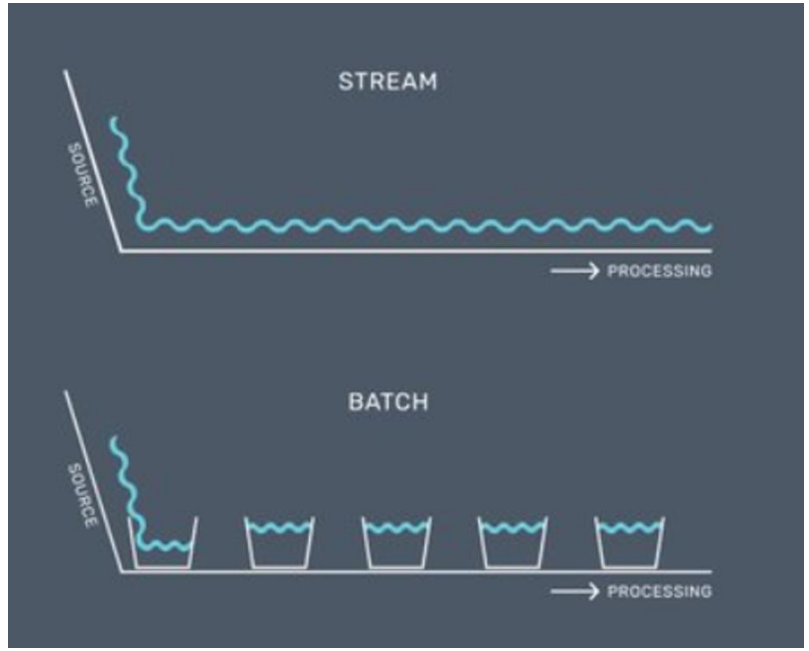
New technical challenges in machine learning for healthcare

Online learning:

- Machine learning algorithms that are able to continuously re-train themselves as new data becomes available.



## 2021 - Disciplina Machine Learning para Predições

Laboratório Labdaps USP - 1 / 13

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| 4 | 1:59:52 | Aula 4 - Disciplina Machine Learning para Predições em... Laboratório Labdaps USP |
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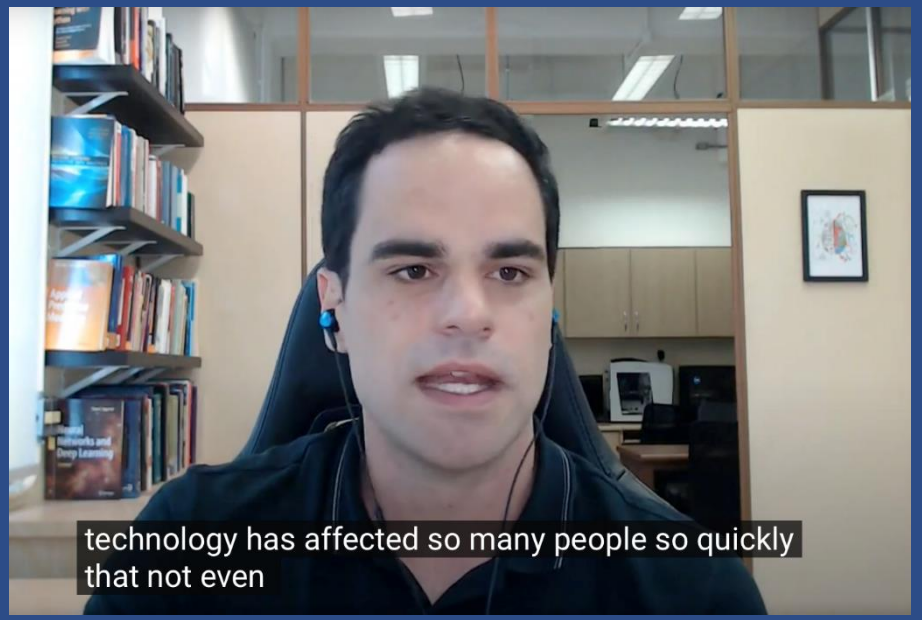
Laboratório Labdaps USP

1,02 mil inscritos

YouTube



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*Thank you!*

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