Bumblekite 2024

Date: July 2nd, 2024

UNCOVERING BIAS IN CLINICAL DATA

SpO2, SaO2, and Hidden Hypoxemia

Presented by: Aya El Mir

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AYA EL MIR

- From Rabat, Morocco
- Class of 2024 Graduate from New York University Abu Dhabi
- Majored in Computer Engineering
- I love colors!

MY TYPICAL DAY SCHEDULE 🌞

- 7:00 AM: Wake up ⏰
- 7:30 AM: Breakfast 🥞
- 8:00 AM: Filter emails 📧
- 9:00 AM: On my way to the lab
- 9:00 AM - 5:00 PM: Work in the lab 💻
- 5:10 PM: Relax under the palms and read my book 🌴📖
- 5:30 PM: Swim practice 🏊
- 7:00 PM: End swim practice
- 7:30 PM: Dinner 🍽️
- 8:00 PM - 11:00 PM: More work or socialize with friends 👥💬
- 12:00 AM - 1:00 AM: Sleep 🛌💤
- Repeat 🔄

MY JOURNEY

2020

Admitted to my dream university

جامعة نيويورك ابوظبي
NYU | ABU DHABI

2021

Cyber Security Research

MoMA Lab

2022

Neuroscience and Data Science Research

Klinikum rechts der Isar
Technische Universität München

2023

Start of passion for ML & Health

NYU

Society of Critical Care Medicine
The Intensive Care Professionals

2024

Bachelor Thesis & Graduation

جامعة نيويورك ابوظبي
NYU | ABU DHABI

2025

Research Assistant, eBRAIN Lab

جامعة نيويورك ابوظبي
NYU | ABU DHABI

MY JOURNEY

What you do not see in my LinkedIn...

2020

COVID-19 pandemic disrupted plans

2021

- Explored cyber security
- Discovered more of what I don't like than what I do

2022

- Took various engineering courses and a synthetic biology course
- Still searching for my passion

2023

- Faced the most challenging academic year
- Nearly failed a class

2024

- Conflicted between pursuing a PhD or entering the industry

2025

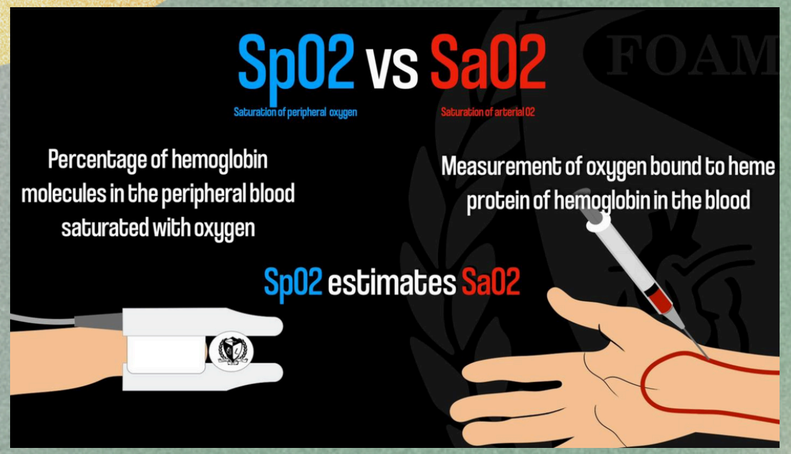
Decided to delve deeper into research to see if it aligns with my interests

WHO AM I BEYOND MY CAREER?

TUTORIAL

WHAT IS THE PROBLEM?

MEASURING OXYGEN SATURATION



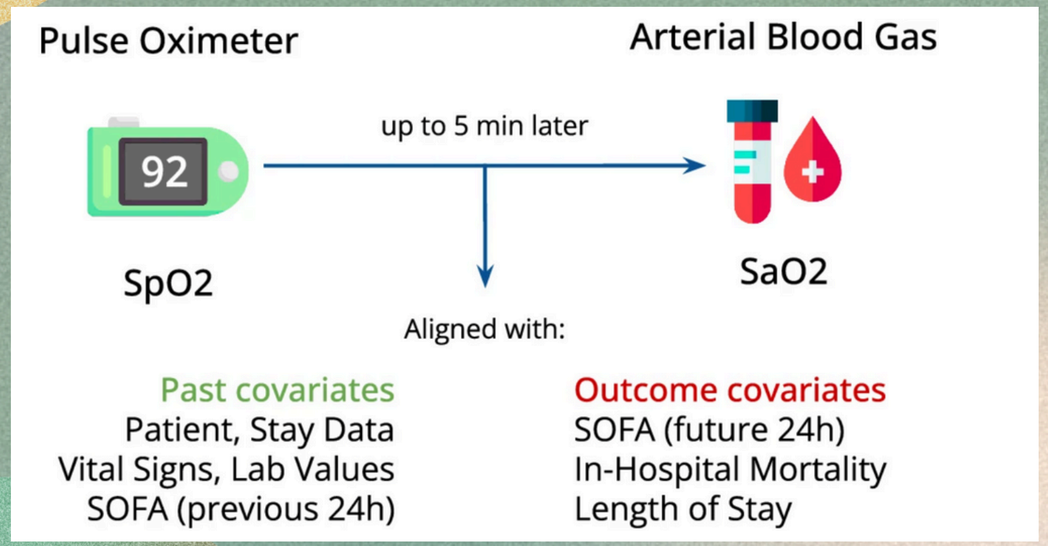
SpO2: Pulse Oximetry

- Non-invasive method
- Device clipped onto finger, toe, or earlobe
- Normal SpO2 levels: 95% to 100%
- Below 95%: Indicates hypoxemia
- Below 85%: Indicates severe hypoxemia

Arterial Oxygen Saturation (SaO2)

- Invasive method
- Measurement from arterial blood using ABG test
- More accurate than pulse oximetry
- Requires drawing blood from an artery
- Used to confirm SpO2 accuracy, especially in suspected hypoxemia cases

BLOOD-GAS AND OXIMETRY LINKED DATASET (BOLD)



- Purpose: Address biases in pulse oximetry accuracy, affecting darker-skinned patients.
- Data Source: Harmonized from three Electronic Health Record databases (MIMIC-III, MIMIC-IV, eICU-CRD) of ICU stays in the US.
- Measurements: Paired SpO2 and SaO2 readings, time-aligned within a 5-minute window.
- Sample Size: 49,099 paired measurements.
- Oxygen Saturation Levels: Range between 70% to 100%.
- Minority Representation: Minority racial and ethnic groups make up ~25% of the dataset.

OBJECTIVE: DISCOVERING THE BIAS

- Provide a comprehensive guide on analyzing and addressing biases in healthcare data.
- Focus on hidden hypoxemia and its impact on in-hospital mortality predictions.
- Structured steps include exploratory data analysis, data preprocessing, train-test splitting, and model evaluation.

CODE :)

KEY TAKEAWAY

- Understanding the importance of the origins and potential biases of the variables used in clinical measurements throughout the whole ML pipeline.
- By revealing the limitations of relying solely on SpO2, we highlight how combining SpO2 with SaO2 provides a more accurate and equitable assessment of patients' oxygen levels.

PLOS DIGITAL HEALTH

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

Machine learning for healthcare that matters: Reorienting from technical novelty to equitable impact

Aparna Balagopalan, Ioana Baldini, Leo Anthony Celi, Judy Gichoya, Liam G. McCoy, Tristan Naumann, Uri Shalit, Mihaela van der Schaar, Kiri L. Wagstaff

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Abstract

Despite significant technical advances in machine learning (ML) over the past several years, the tangible impact of this technology in healthcare has been limited. This is due not only to the particular complexities of healthcare, but also due to structural issues in the machine learning for healthcare (MLHC) community which broadly reward technical novelty over tangible, equitable impact. We structure our work as a healthcare-focused echo of the 2012 paper "Machine Learning that Matters", which highlighted such structural issues in the ML community at large, and offered a series of clearly defined "Impact Challenges" to which the field should orient itself. Drawing on the expertise of a diverse and international group of authors, we engage in a narrative review and examine issues in the research background environment, training processes, evaluation metrics, and deployment protocols which act to limit the real-world applicability of MLHC. Broadly, we seek to distinguish between *machine learning ON healthcare data* and *machine learning FOR healthcare*—the former of which sees healthcare as merely a source of interesting technical challenges, and the latter of which regards ML as a tool in service of meeting tangible clinical needs. We offer specific recommendations for a series of stakeholders in the field, from ML researchers and clinicians, to the institutions in which they work, and the governments which regulate their data access.

Author summary

The field of machine learning has made significant technical advancements over the past several years, but the impact of this technology on healthcare practice has remained limited. We identify issues in the structure of the field of machine learning for healthcare which incentivise work that is scientifically novel over work that ultimately impacts patients. Among

Subject Areas

Machine learning
Machine learning algorit...
Allied health care profes...
Artificial intelligence
Maternal mortality
Socioeconomic aspects ...
Open data
Pain

THANK YOU FOR YOUR ATTENTION 😊