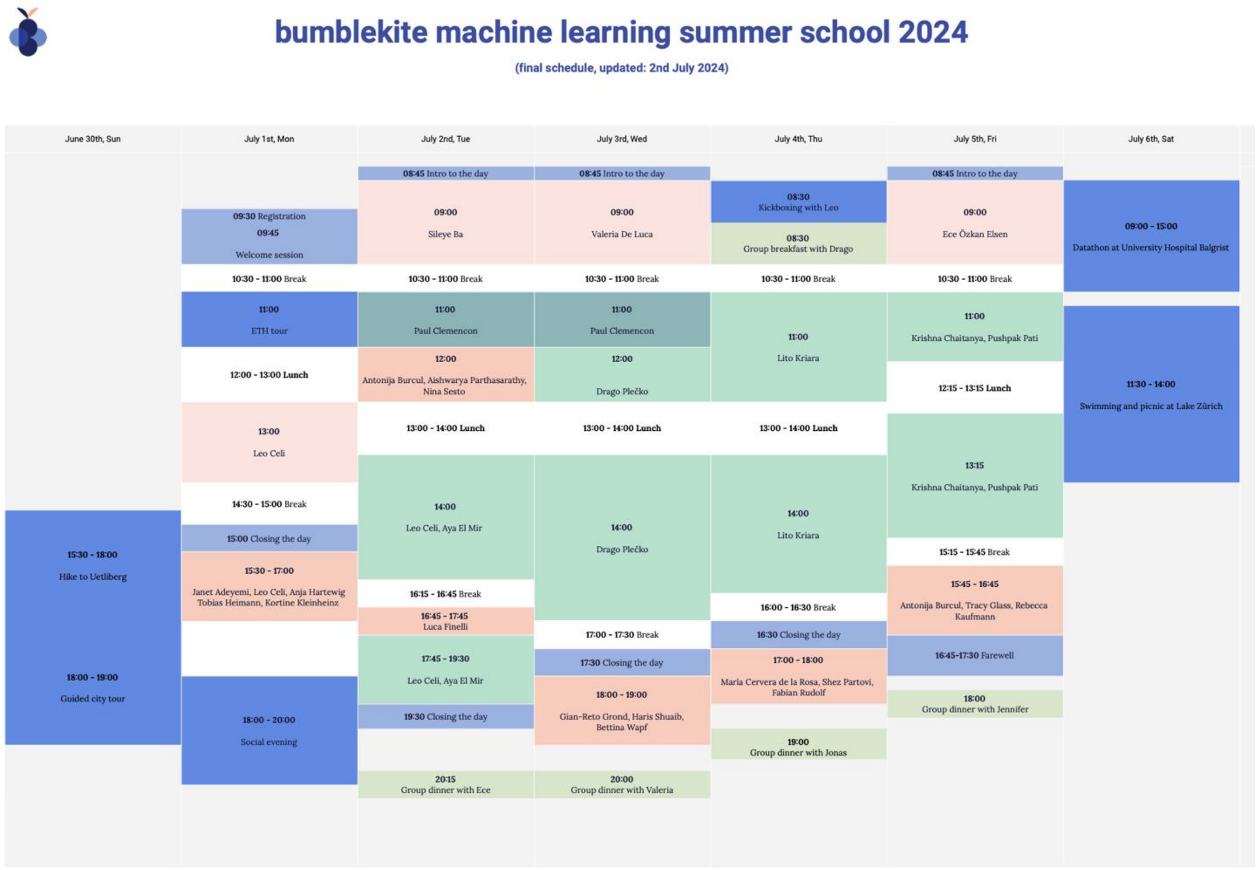
# Bumblekite

Machine learning summer school in health, care and biosciences

ETH Zürich, Switzerland

# General information

- Annual machine learning summer school
- Target audience:
  - Early career professionals
  - Students (graduate)
- A dynamic schedule:
  - Lectures
  - Tutorials
  - Leadership conversation series
  - Communication sessions



# Lectures

**Bias in AI**

- Data is context dependent
- The need to be critical in ML
- Expert knowledge
- Interdisciplinarity

**ML in L'OREAL**

- Skin tone prediction (CNNs)
- Foundation & lipstick recommendation (CAGAN)
- Skin condition prediction
- Problems with sensor data

# Lectures (2)

**ML in Novartis**

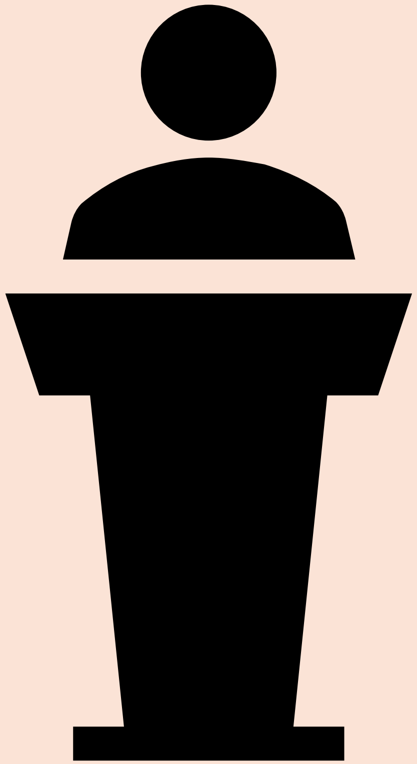
- Use of clinical omics
- Disease markers
- Parkinson’s disease, kidney disease, etc.

**ML in Roche**

- Prioritizing fairness & interpretability
- Debiasing deep chest x-ray classifiers
- Prediction of pulmonary hypotension in newborns
- Prediction of appendicitis

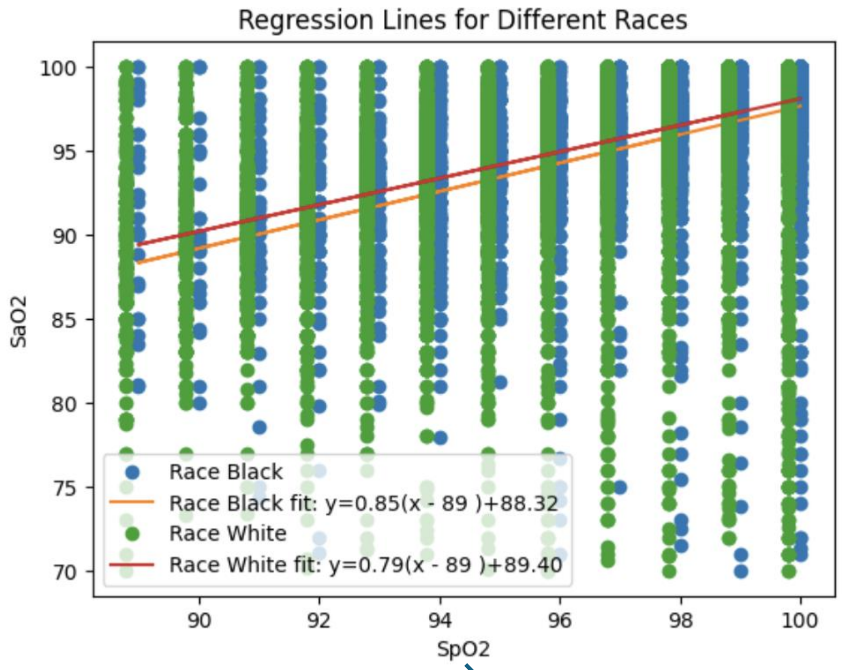
# Communiation lecture

- Communication & business development
- **Importance of negotiation**
  - Value vs price
  - Buy when value > price
- Case study



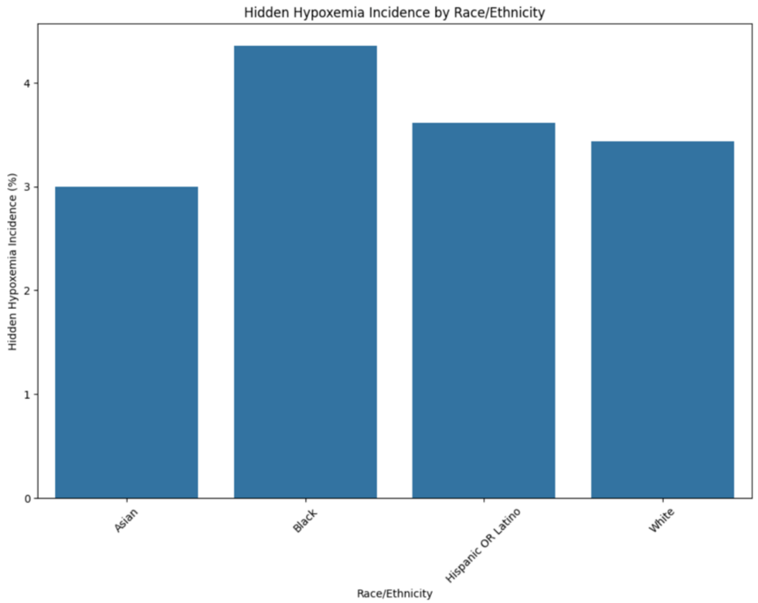
# Tutorials

An invasive measurement of oxygen saturation directly from the blood using an arterial blood gas test.




**Bias in AI**

- BOLD dataset
- Bias in pulse oximetry accuracy
    - Biased towards darker-skinned patients
    - Hidden hypoxemia
- Predicting in-hospital mortality
- Emphasis on examining bias, not ML




*A non-invasive method used to measure the oxygen level in the blood. It is usually done using a device clipped onto a finger, toe, or earlobe.*

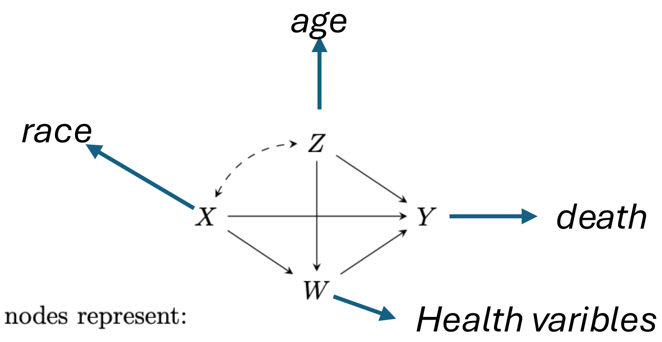
| | features | race_ethnicity | auc | Weighted Precision | Weighted Recall | Weighted F1-Score | balanced_accuracy |
|---|---|---|---|---|---|---|---|
| 3 | Exaggerated SpO2 | Asian | 0.727519 | 0.852817 | 0.860759 | 0.819215 | 0.576241 |
| 3 | SaO2 | Asian | 0.726617 | 0.840190 | 0.854430 | 0.807050 | 0.556241 |
| 3 | SpO2 | Asian | 0.728421 | 0.852817 | 0.860759 | 0.819215 | 0.576241 |
| 1 | Exaggerated SpO2 | Black | 0.758489 | 0.797087 | 0.832432 | 0.794723 | 0.572467 |
| 1 | SaO2 | Black | 0.759869 | 0.797797 | 0.832432 | 0.796895 | 0.577410 |
| 1 | SpO2 | Black | 0.760139 | 0.805853 | 0.836757 | 0.801089 | 0.582496 |
| 2 | Exaggerated SpO2 | Hispanic OR Latino | 0.782582 | 0.801163 | 0.822014 | 0.783712 | 0.597269 |
| 2 | SaO2 | Hispanic OR Latino | 0.775523 | 0.792869 | 0.817330 | 0.775786 | 0.585641 |
| 2 | SpO2 | Hispanic OR Latino | 0.782923 | 0.801163 | 0.822014 | 0.783712 | 0.597269 |
| 0 | Exaggerated SpO2 | White | 0.789874 | 0.825862 | 0.844906 | 0.808421 | 0.594704 |
| 0 | SaO2 | White | 0.786374 | 0.825589 | 0.844640 | 0.807706 | 0.593354 |
| 0 | SpO2 | White | 0.789897 | 0.826829 | 0.845172 | 0.808235 | 0.593974 |

- **Logistic regression** results for each race; different features

# Tutorials (2)

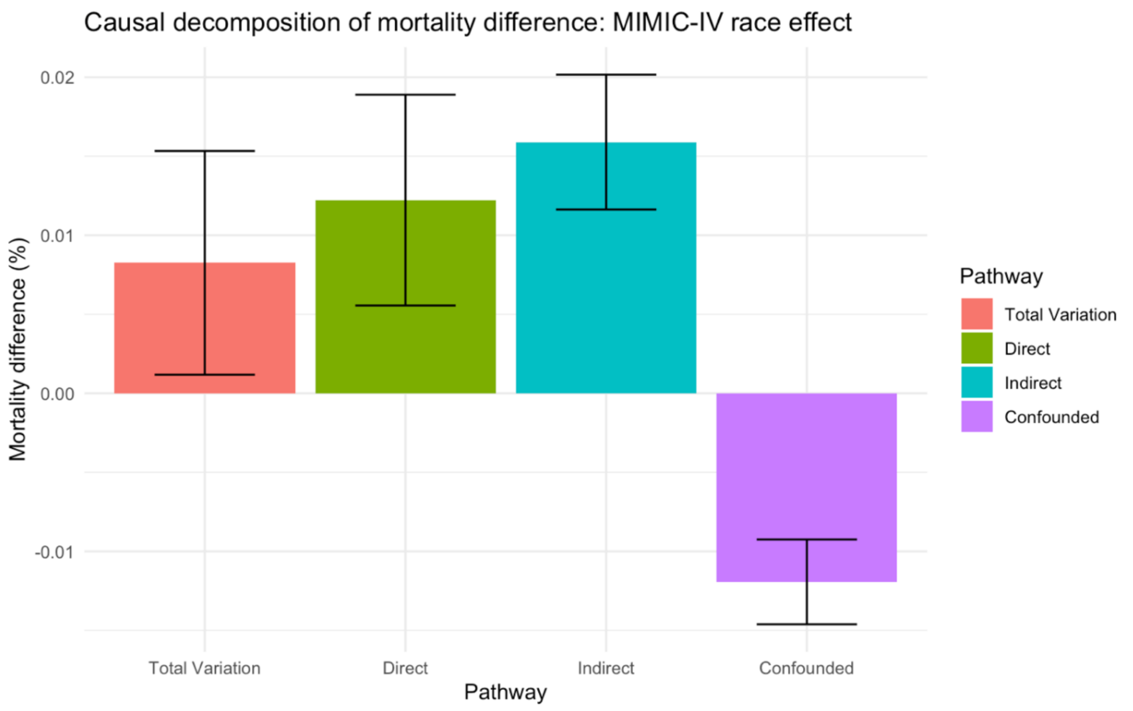
**Causal fairness analysis**

- MIMIC-IV dataset
  - Health variables + mortality
- Standard fairness model




where the nodes represent:

- the *protected attribute*, labeled $X$ (e.g., gender, race, religion),
- the set of *confounding* variables $Z$, which are not causally influenced by the attribute $X$ (e.g., demographic information, zip code),
- the set of *mediator* variables $W$ that are possibly causally influenced by the attribute (e.g., educational level or other job-related information),
- the *outcome* variable $Y$ (e.g., admissions, hiring, salary).

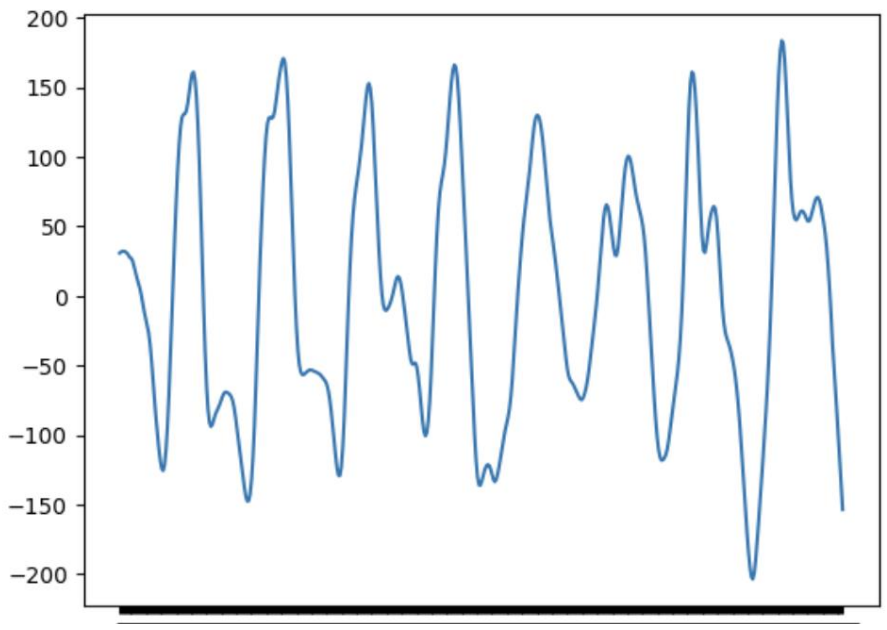



[Want to learn more?]

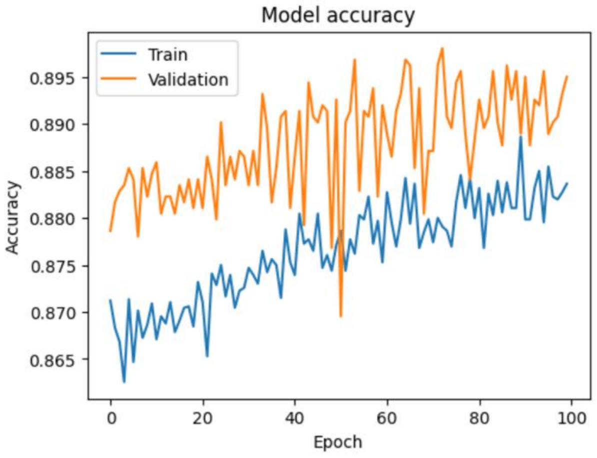
# Tutorials (3)

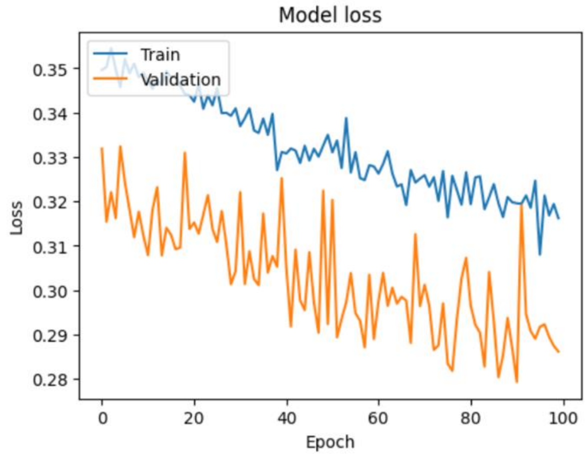
**Noise in data**

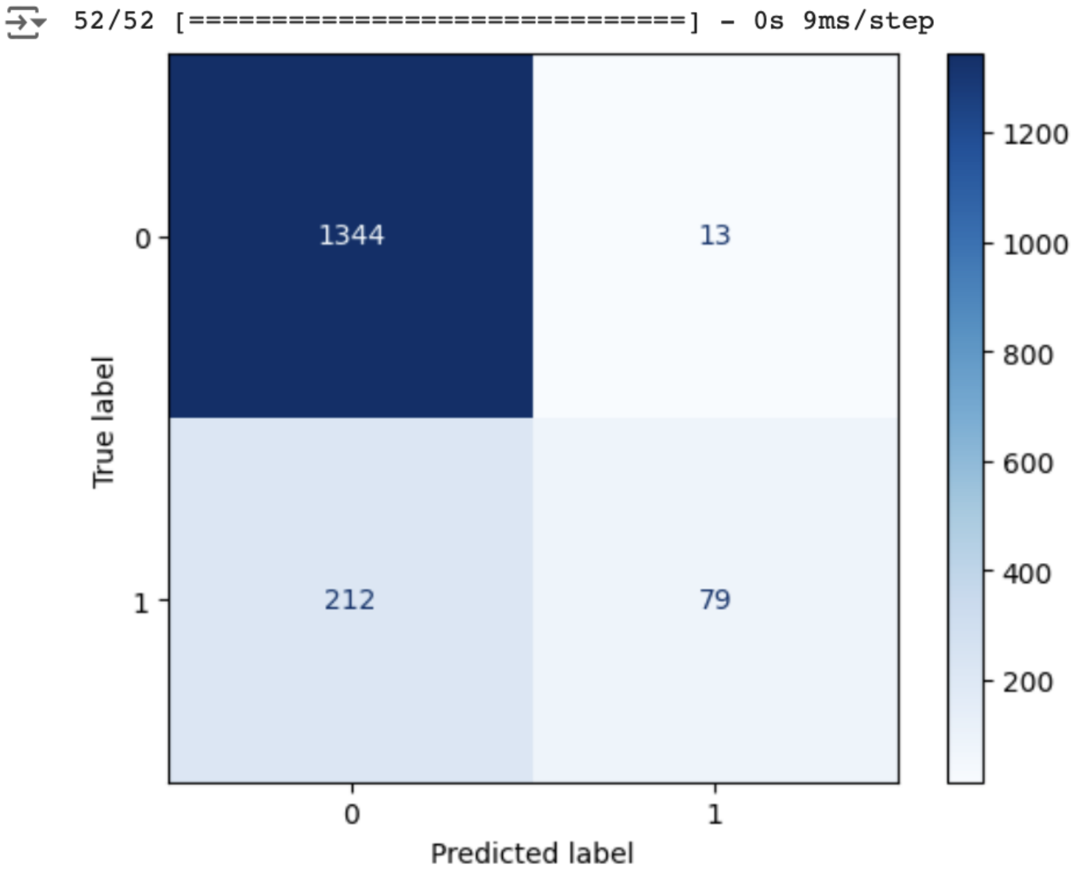
- Deep learning (CNN)
- PPG data
- Dependent instances
- Predicting noisiness of the data
- High accuracy, low/decreasing loss




```
206/206 [==============================] - 6s 27ms/step - loss: 0.3194 - accuracy: 0.8827 - val_loss: 0.2875 - val_accuracy: (
Epoch 100/100
206/206 [==============================] - 7s 36ms/step - loss: 0.3162 - accuracy: 0.8836 - val_loss: 0.2862 - val_accuracy: (
52/52 [==============================] - 1s 10ms/step - loss: 0.3656 - accuracy: 0.8635
Test Loss: 0.365626126527778625
Test Accuracy: 0.86347085237503050
```

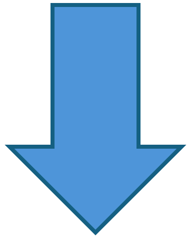





**After examining the confusion matrix ...**

- Model classifies into category 0
- Train data with imbalanced labels



Solutions?

# Social activities, networking

- A lot of events
- Dinners with lecturers
- Community building