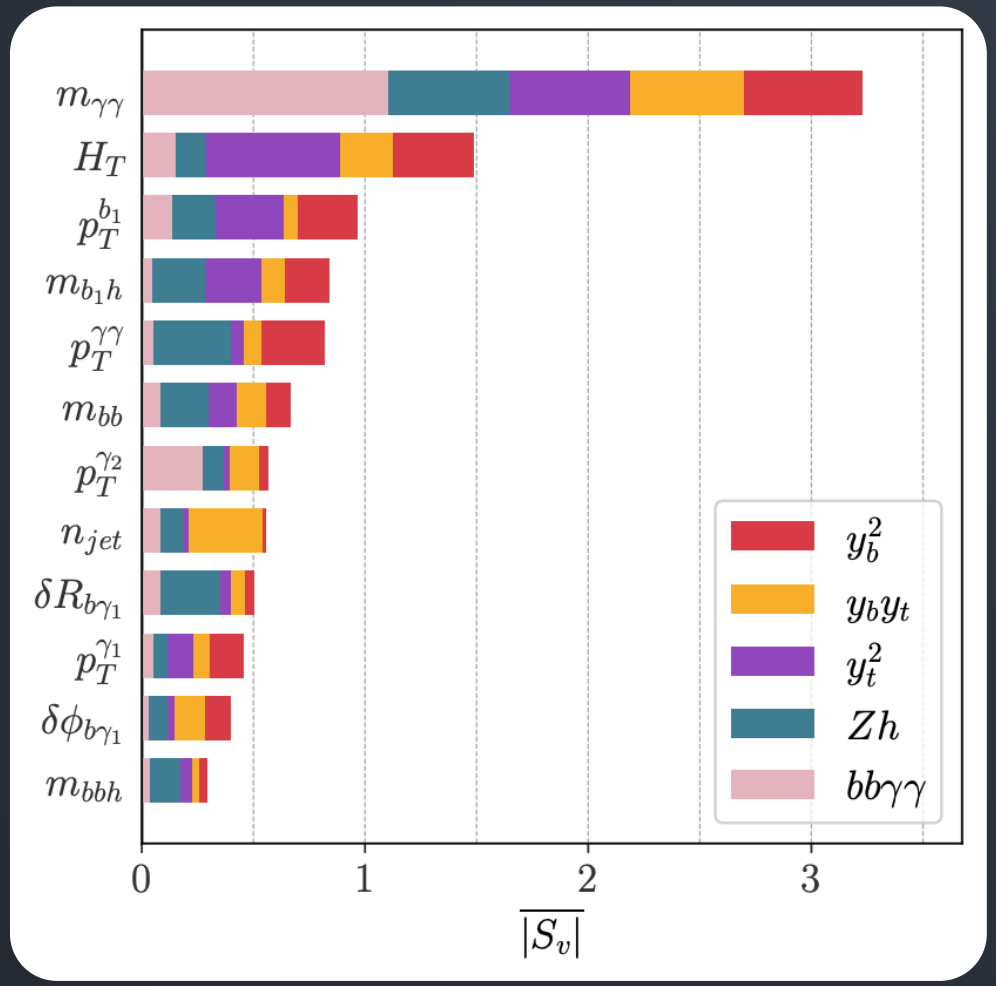
Machine Intelligence @DESY-Theory

Ayan Paul

4th December 2020

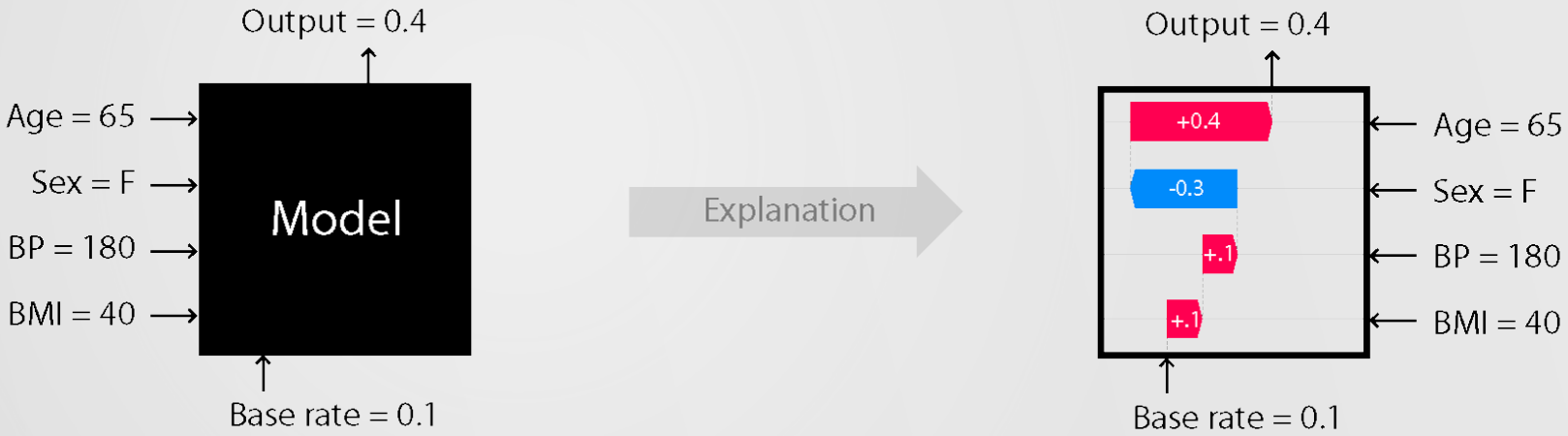


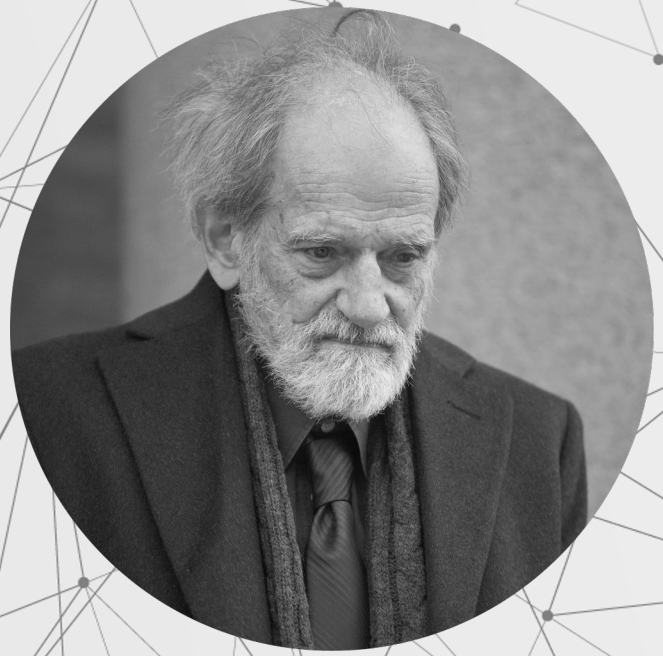
Particle Physics & Interpretable Machine Learning

Higgs production in association with a bottom-quark pair:
was formerly declared impossible

SHAP values (2013 –)

SHAP



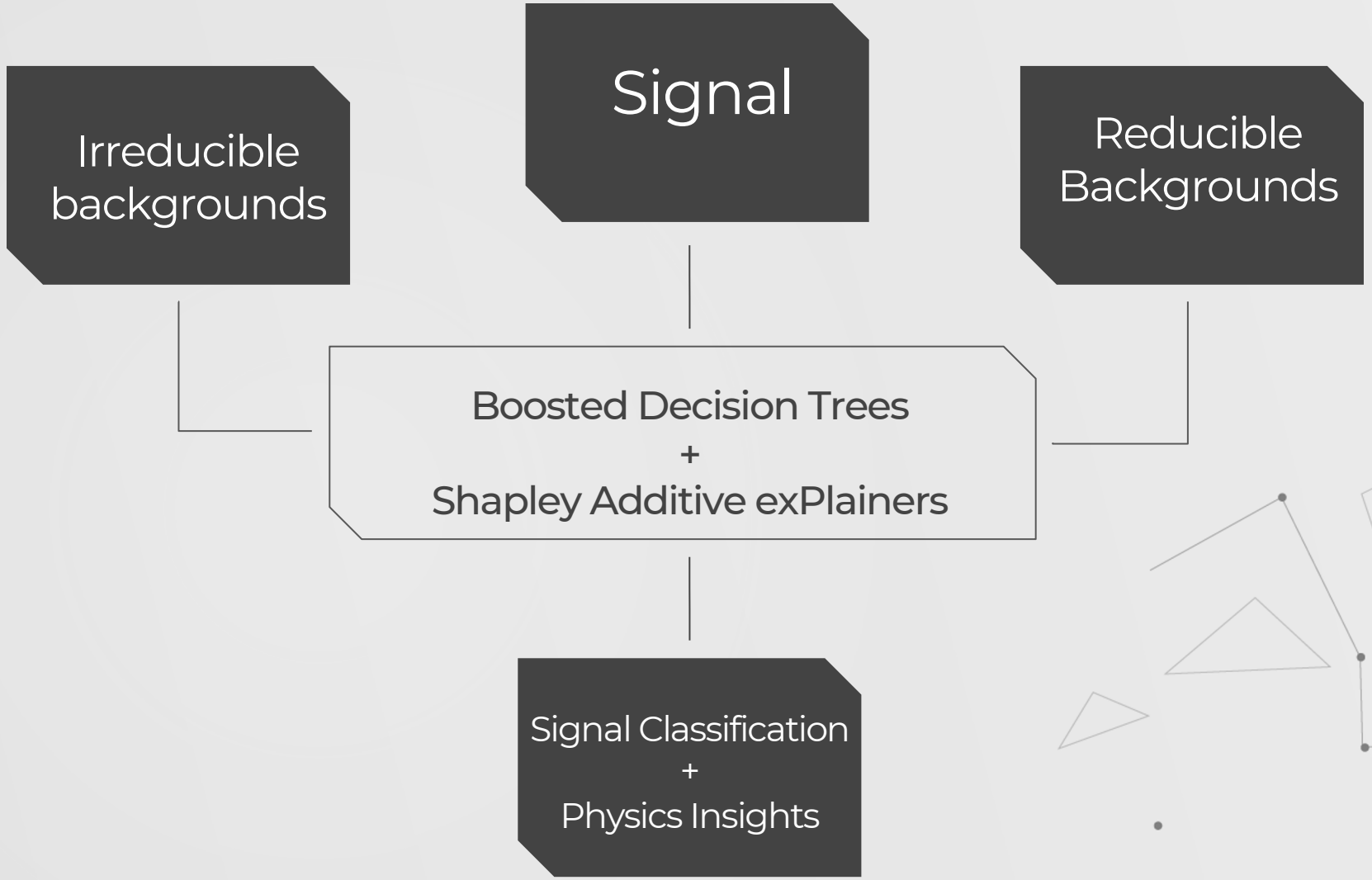


Lloyd S, Shapley

Nobel Laureate 2012

E. Štrumbelj and I. Kononenko, Explaining prediction models and individual predictions with feature contributions. Knowledge and Information Systems 41, 647–665 (2014)

the strategy



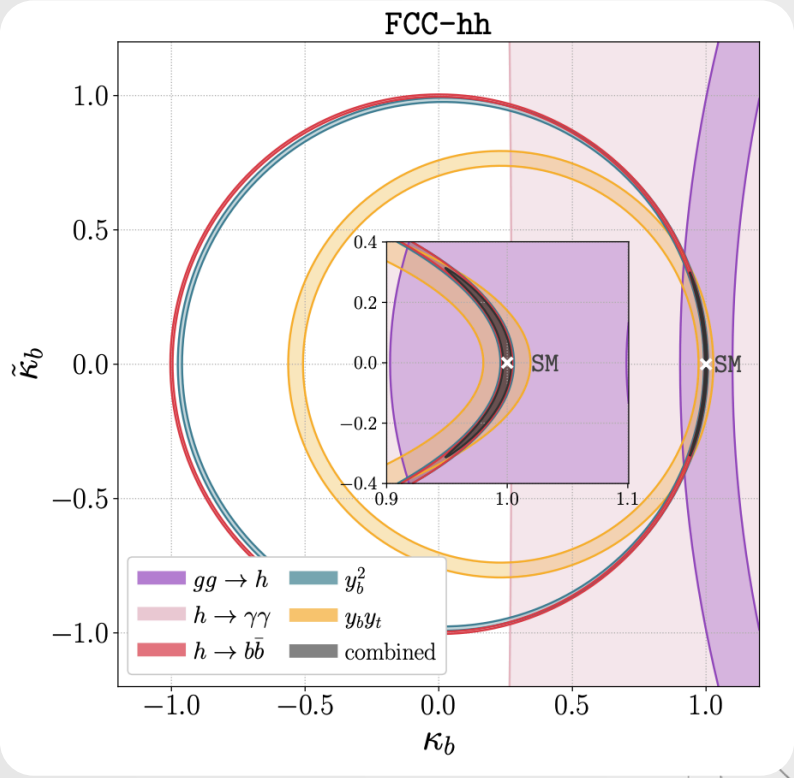
S. M. Lundberg et al., From local explanations to global understanding with explainable AI for trees. Nature Machine Intelligence 2, 56–67 (2020)

Factor of ~2 gain in significance over traditional cut-based analyses.

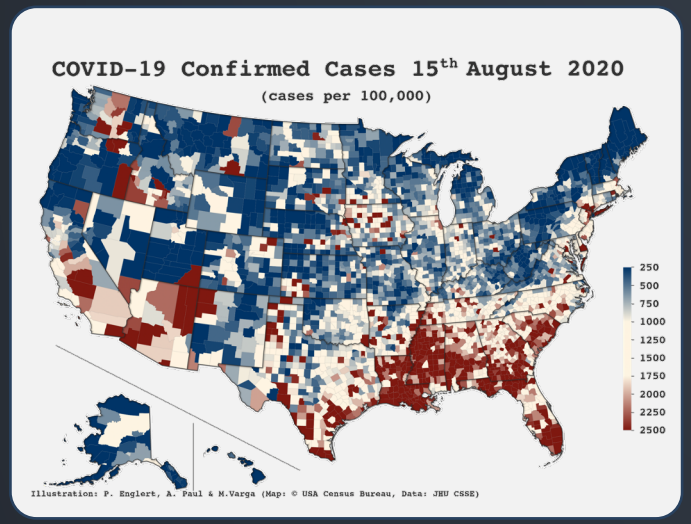
Competitive with other bottom-quark Yukawa measurements @ FCC-hh.

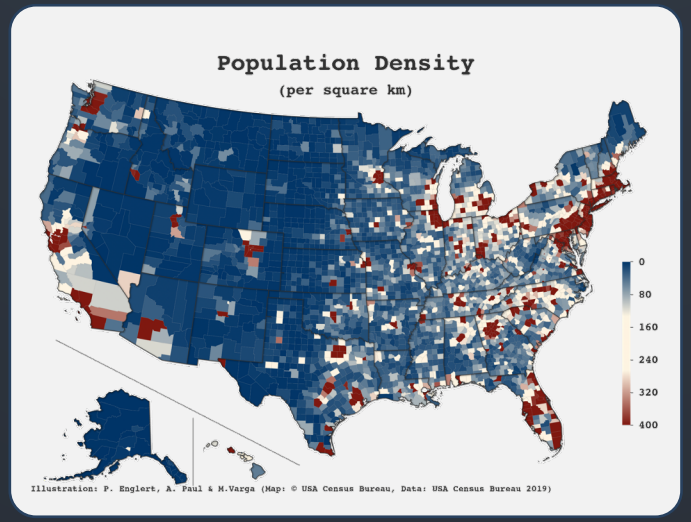
Shapley values provide insights into the underlying physics – ML algorithm is no longer a ‘black-box’.

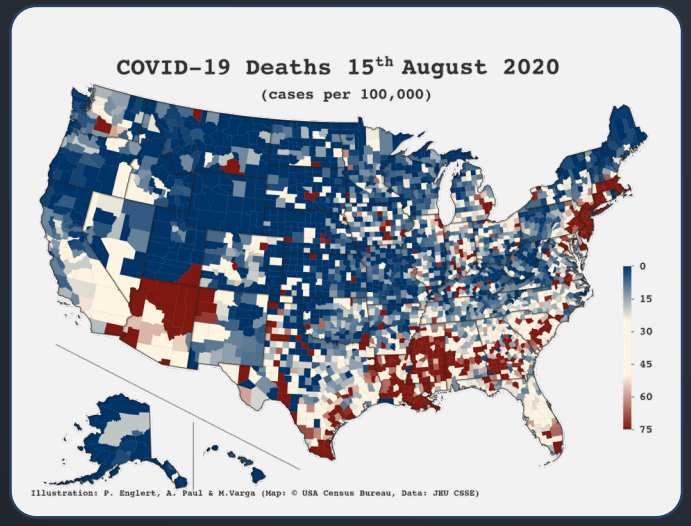
Projections made for HL-LHC and FCC-hh @ CERN



C. Grojean, A. Paul and Zhuoni Qian, Ressurecting *bbh* with kinematic shapes.
arXiv: 2011.13945

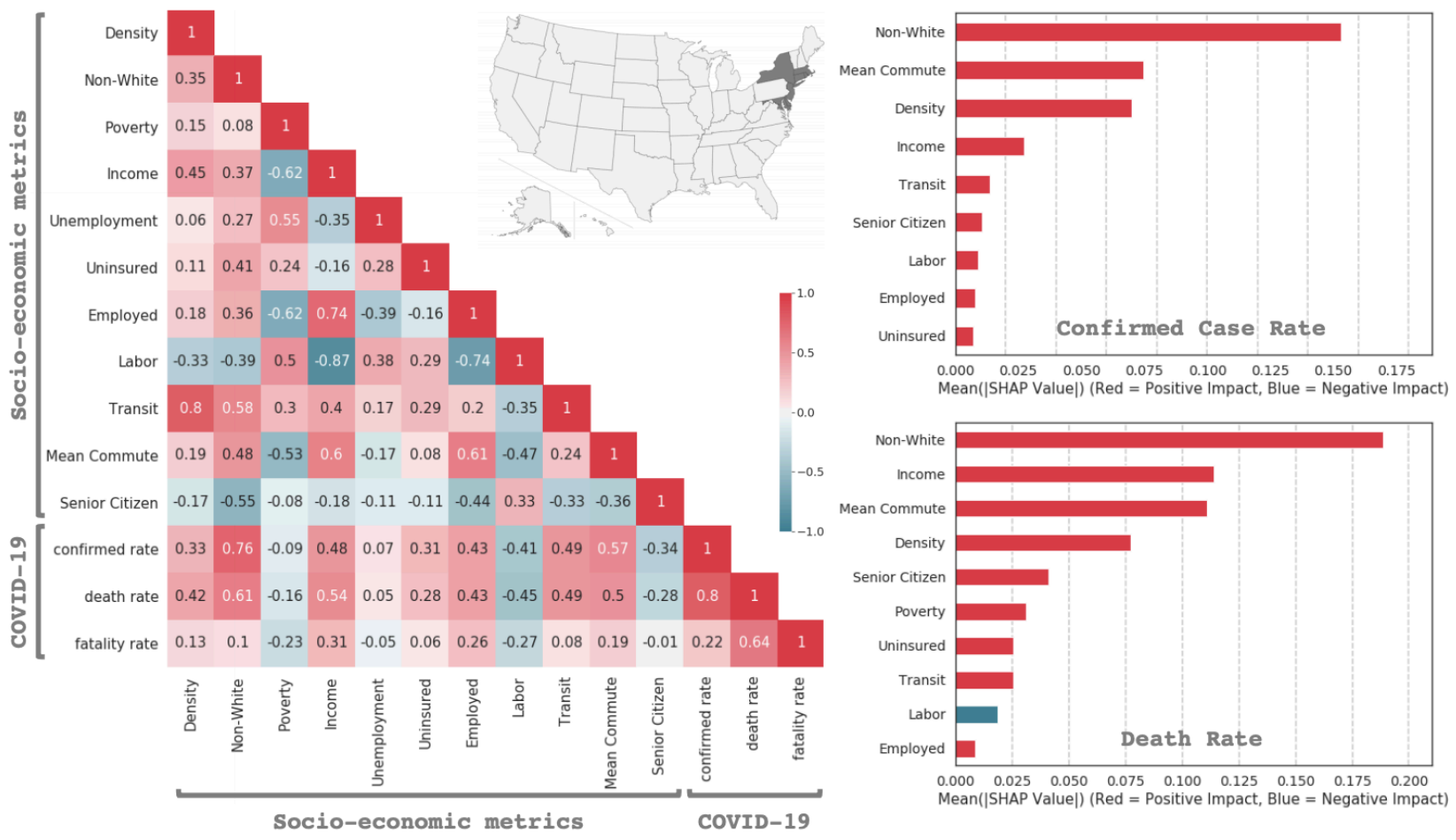






COVID-19 and socioeconomic disparities

"we are all in the same storm but we are not all in the same boat"

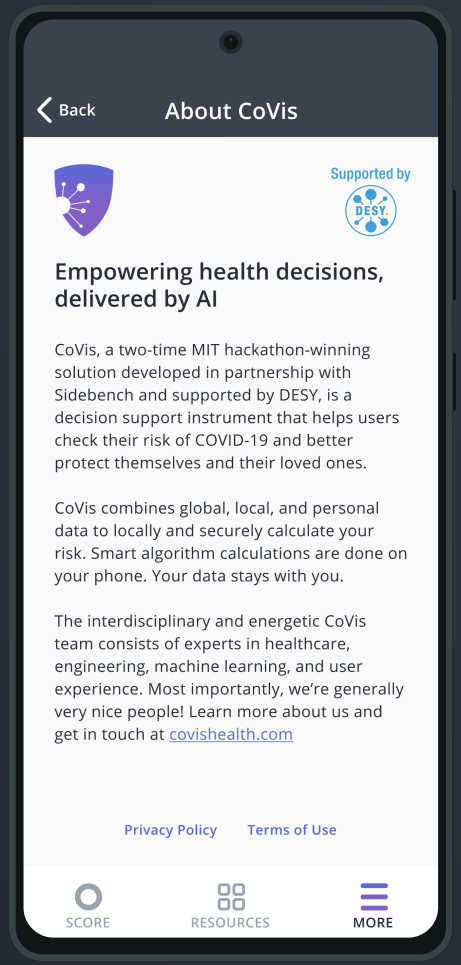


Counties with larger fraction of non-white population are getting affected the most.

Other than the east coast, the counties with larger fraction of young people are getting preferentially affected.

Fatality rates are independent of the socioeconomic metrics.

A. Paul, P. Englert and M. Varga, Socio-economic conditions and COVID-19 in the USA, DOI:10.1101/2020.09.10.20192138. under peer-review.



CoVis: Intelligent Algorithms for COVID-19 risk assessment

Developed with:
DESY Strategy Fund Grant

The founding of CoVis

CoVis is founded at the the MIT “Beat the Pandemic” hackathon. The 7-member team wins the hackathon proposing real-time risk and immunity assessment for individual for COVID-19

April 2020

CoVis wins again!

For 2 months the CoVis team develops the algorithms, the idea, the backend and the designs the app. CoVis competes in the MIT “Beat the Pandemic II” hackathon against advanced teams and wins again!

June 2020

CoVis gets DSF Grant

CoVis gets a 100,000€ grant from DESY to build the CoVis app and to develop business strategies to make it sustainable. The CoVis team has now grown to over 10 members.

July 2020

CoVis approaches clients

CoVis starts planning on its future. Several companies are approached in Germany and the USA. CoVis discusses plans with Duetsche Bank, HOYER, TK, Allways, Moogsoft, MSH, PwC etc.

August 2020

October 2020

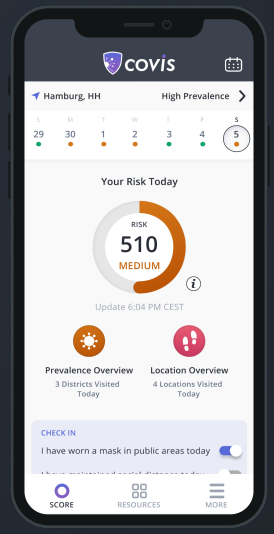
The CoVis app

CoVis and Sidebench start building the app. The backend, the app designs and algorithms are built by the CoVis team while the frontend is built by Sidebench.

January – February 2021

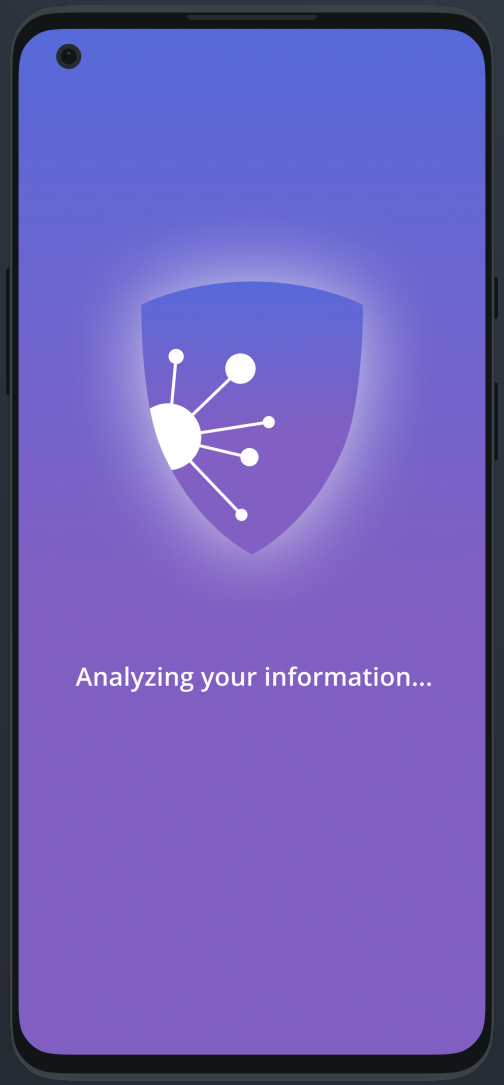
CoVis goes live!

The CoVis app is slated for launch in January/February 2021 in Germany and the USA. CoVis is looking forward to partnering with companies and moving to other countries.



Sidebench

App will be launched in Germany and the USA



Forecasts for COVID-19 spread are being done for 3142 counties in the USA, 401 districts in Germany and 206 other countries

ARIMA takes about 5 mins on 8 cores. NNs take ~1 min to train for each division.

Forecasts being tested on LSTM/GRU architectures. Accuracy comparable to ARIMA.

Diversity@DESY-Theory

- **Diversity@DESY-Theory** was started in June 2020 by Postdocs and PhD students as consolidation of efforts for BLM throughout the international academic community.
- **Philosophy:** Diversity covers all kinds of variation in the academic world (gender, religion, etc.) and they should be accommodated for.
- A monthly remote meeting is held where different issues related to diversity are discussed which includes published articles and opinions.
- The Diversity Office of the Universe Cluster has been included with Eileen Schwanold providing expert advice on topics and actions.
- A core group of postdocs and students will be formed that can be approached by other members of DESY in case they want an unbiased discussion about any issues on diversity they might be facing.
- Topics related to diversity will be raised in workshops and conferences as a way of making people more aware of the core issues.
- Possible external outreach to other academic institutions to consolidate efforts of increasing inclusion in academia.
- The core group is managed by: Davide Pagani, Ayan Paul and Jorinde van de Vis.

Thank you!

covishealth.com
desy.de/~apaul

Spin-off by