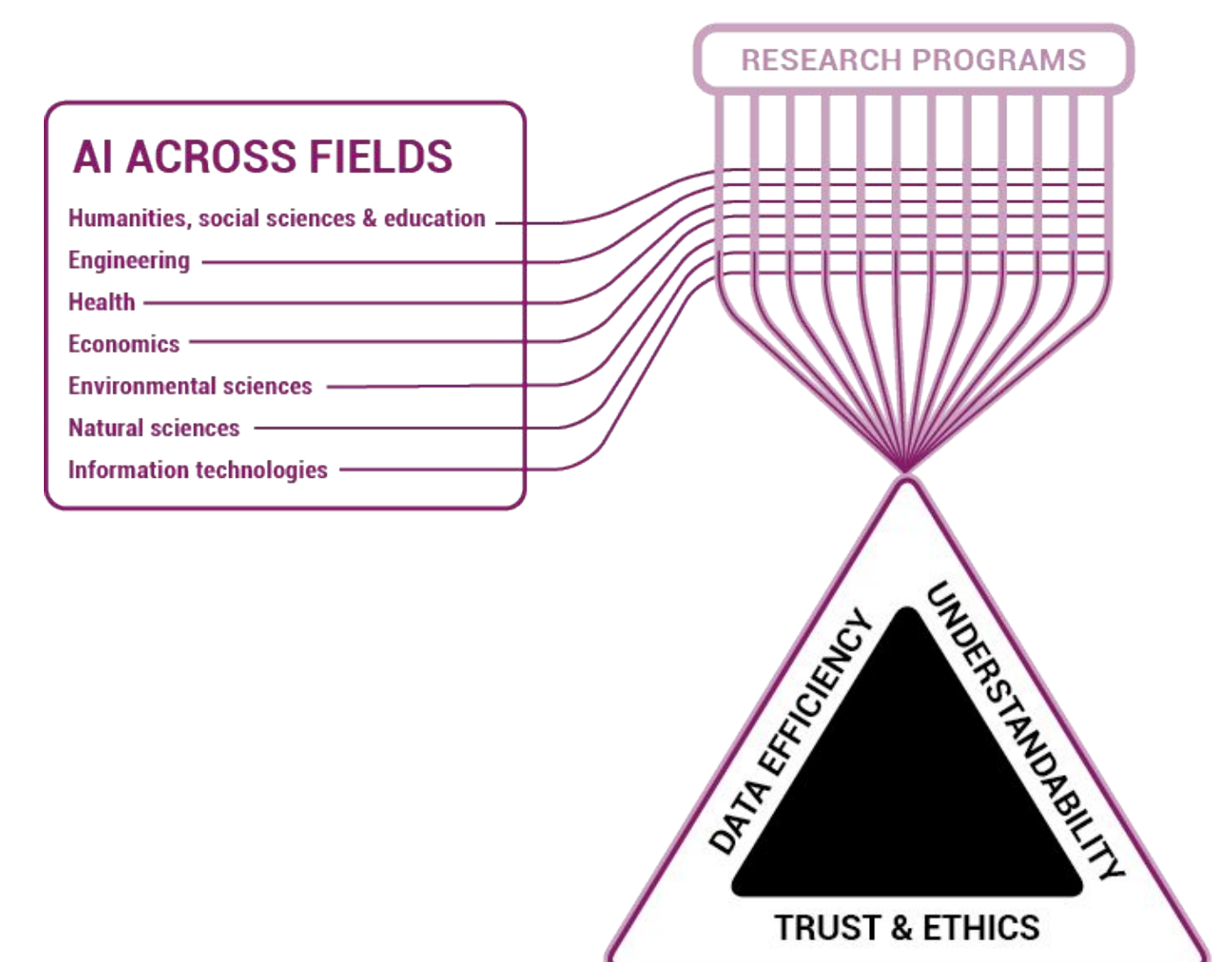


Simulator-based inference (Research Program R2)

Our goal is to develop simulation-based methods to learn generative models from the data.



Program objectives

- Develop ELFI software project (elfi.ai) for fitting interpretable simulator-based models to data. Aim is to push ELFI into community driven project



- Develop complementary neural network based approaches, e.g., GANs, to fitting interpretable simulator-based models to data. Aim is to achieve sharper inference while accepting higher computational cost.

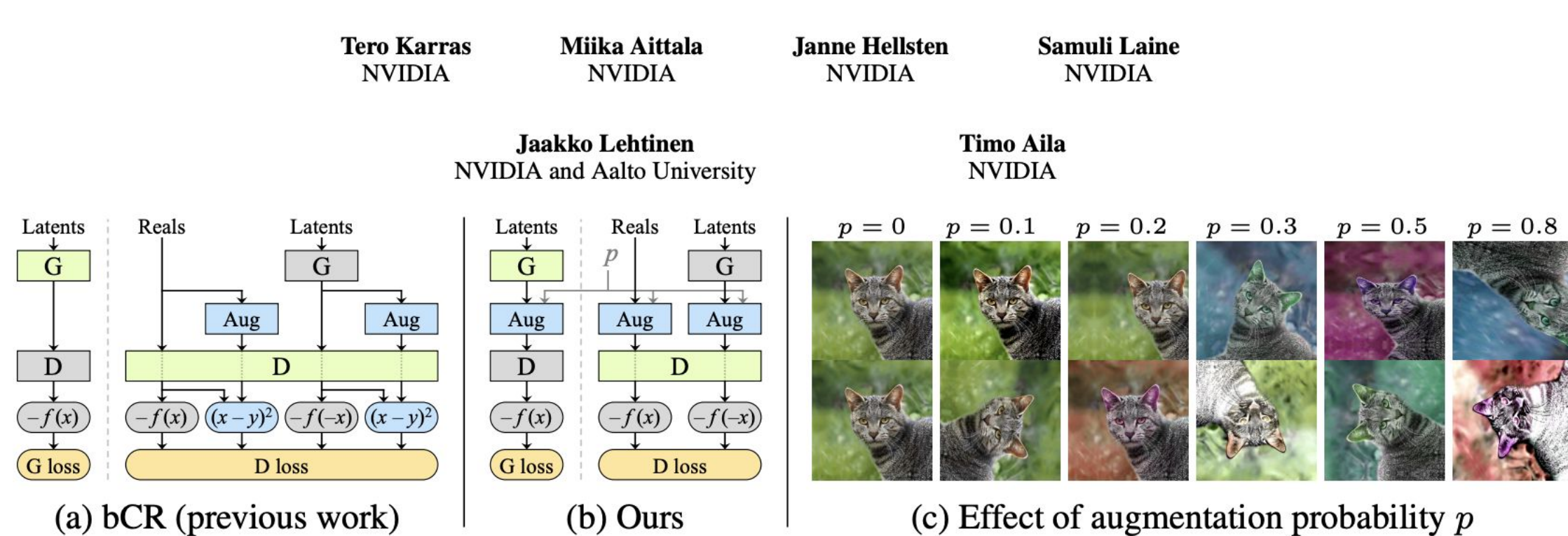
Methodologies

- We develop and implement state-of-the-art simulator-based inference methods. We aim to enhance the usability of ELFI by adopting the current the best development practices.
- Generative neural network models (GANs etc.)
- Flow-based likelihood-free inference methods

Research highlights

- Data-efficient GANs: up to 90% reduction in amount of data needed for training high-quality GANs (NeurIPS 2020 oral presentation = top-1% of accepted papers)

Training Generative Adversarial Networks with Limited Data



- Unsupervised post-hoc discovery of interpretable controls for GANs: allows intuitive control, and enables studying the learned representations by giving a broad picture of the factors learned (NeurIPS 2020)

GANSpace: Discovering Interpretable GAN Controls

Erik Härkönen^{1,2} Aaron Hertzmann² Jaakko Lehtinen^{1,3} Sylvain Paris²
¹Aalto University ²Adobe Research ³NVIDIA

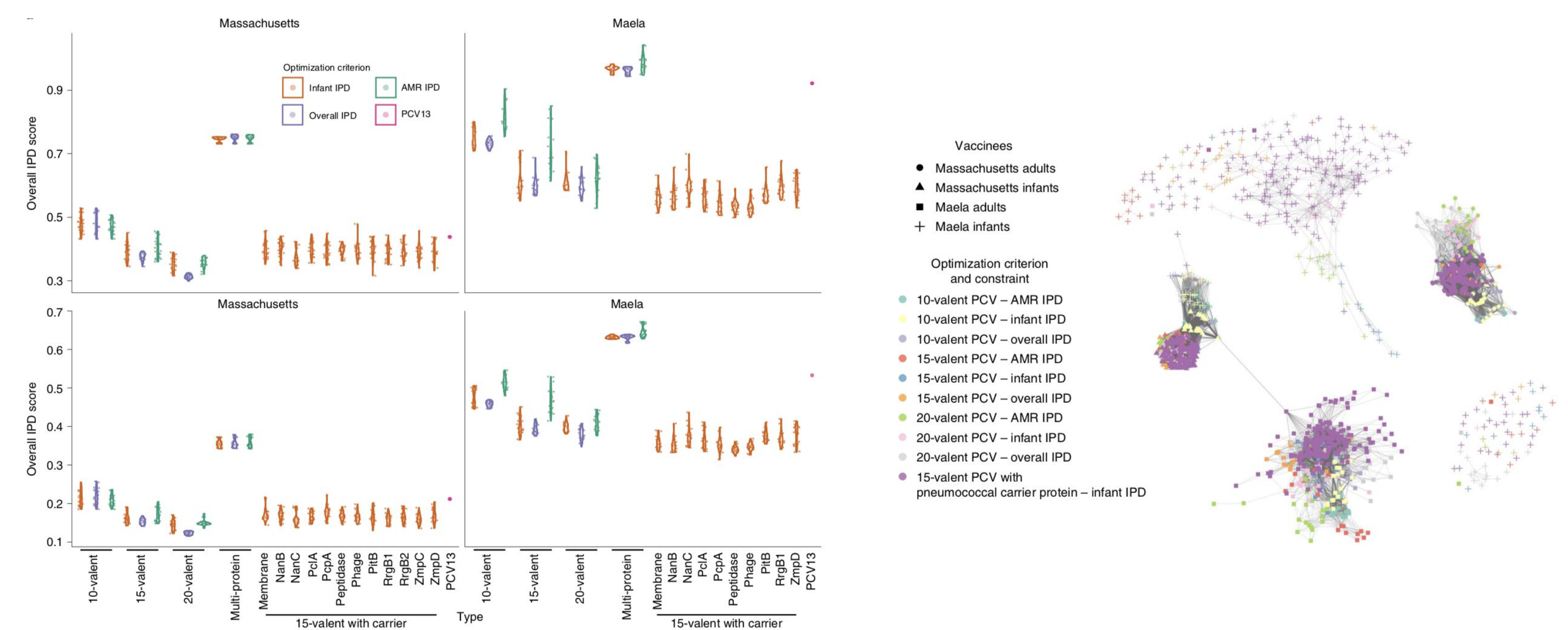


Research highlights

Designing ecologically optimized pneumococcal vaccines using population genomics (Caroline Colijn, Jukka Corander & Nicholas J. Croucher)

- Identification of protein-polysaccharide conjugate vaccines expected to minimize the post-vaccine invasive pneumococcal disease burden by applying Bayesian optimization to an ecological model of serotype replacement that integrated epidemiological and genomic data.

(Nature Microbiology volume 5, pp. 473–485 (2020))



ELFI-development (now available or up-and-coming)

Methods

- PYLFIRE/BONFIRE
- Likelihood-Free Inference with Deep Gaussian Processes
- BOLFI-approximation for high-dimensional spaces
- Robust optimized Monte Carlo
- Amortized LFIRE

Features

- Dask-support for automatic parallelization
- Adaptive threshold selection for ABC-PMC

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