



**Figure 1.** Children learning how image recognition works (left), training PoseNet with cheerleader poses (center), and recording and labeling instrument samples for an instrument recognition model (right).

# GENERATION AI

**The deep learning revolution of the 2010s redefined the ICT landscape.** Machine learning (ML) and other data-driven approaches have transformed the mechanisms of media, knowledge work, services, advertisement, and communication, among other things. In many fields ML applications reach into areas where traditional programming does not reach, and companies and governments are exploring how to exploit its opportunities.

**People have become sensitive to security risks related to data.** The extent of tracking, data mining, profiling, and modeling have fueled anxiety over security and safety of data collection in ubiquitous computing systems. News of data leaks, privacy breaches, security threats, abuse of trust, and commercial farming of user data have brought to the public consciousness risks related to massive data collection. The very foundations of democratic societies have been shaken by algorithmically optimized spread of mis- and disinformation, swaying political moods, state-led hybrid influencing, and behavior engineering. All these have been used to erode people’s trust on public authorities, media, science, civil society, and their fellow citizens. What is more, surveys show a weakening feeling of control and free will.

**The current approaches to technology education are not well positioned to tackle the above issues.** As ML-based systems pervade people’s lives, understanding how intuition and agency in the context of such systems is developed becomes a key area in learning. Alas, despite the central position of ML in modern computing, the computing education research body of literature contains remarkably few studies of how to prepare citizens for the datafied, ML-driven society. Almost all research on computing education pertains to classical, rule-driven approaches to computing. Because computing education research is not focused on this area, classroom teachers will hardly address the topic when they educate future citizens. Old approaches to technology education fail to teach learners how their services work—take, for instance, TikTok’s spot-on recommendations, automatic tagging of

their friends in photos, and targeted personalized advertisement. Classical programming will not teach children to think in a data-driven way. It will not empower them as citizens in the datafied society. When learning for citizenship in a ML-driven society takes place in out-of-school settings, it does not reach all students, which widens the skills gap between students and prevents the fulfillment of digital and educational inclusion.

**This project develops research-based educational solutions for citizenship in the datafied society.** It tackles the difficult challenges with people’s eroding trust on democracy, egalitarian values, dignity, and fairness in the datafied society, as well as their perceived weak volition and capacity for informed actions that make a difference in their digital world. The project provides new understanding on how to support development of people’s data agency and ability to identify and question the mechanisms and sources of algorithmic bias, brittleness, softness, and opaqueness of machine learning systems. The project aims at inclusively giving learners an understanding of how data-driven technology and artificial intelligence works.

The project focuses on pre-service teachers (university students on their way to becoming teachers) and K-9 children. It studies how the participants perceive the role(s) of data in their lives, their own roles as consumers and producers of data, on their agency and volition regarding automation, and on the most acute threats to feelings of security, trust, and empowerment. It studies where the biggest impact can be made on learners’ data-related strategies, trust, everyday practices, and insight. The project develops ML/XAI based tools for self-study, classroom material, and teaching units to be deployed online and in the classroom. The project also collects evidence on the effectiveness, benefits, drawbacks, and impact that learning ML has on learners’ data agency, attitudes and perceptions of the role of ML in society, and their trust in the realization of their rights, privacy, and fairness in data-driven society.