Machine learning:
what do the public think?

**The Royal Society's public dialogue
on machine learning**

THE ROYAL SOCIETY

What is machine learning?

Machine learning is a branch of artificial intelligence that allows computer systems to learn directly from examples, data, and experience. Through enabling computers to perform specific tasks intelligently, by learning from examples, machine learning systems can carry out complex processes by learning from data, rather than following pre-programmed rules.

The Royal Society has been investigating the potential of this technology over the next five to ten years, and the opportunities and challenges it presents.

The Royal Society's public dialogue on machine learning

From the start of its machine learning project, the Royal Society has been engaging with the public to find out their existing attitudes towards machine learning. A public dialogue exercise on machine learning, carried out during 2016 in conjunction with Ipsos MORI, was a key part of this process.

This research started with a survey of just under 1,000 people, which quantified current awareness of, and views about, machine learning, for a representative sample of the UK public. Quantitative survey data were complemented, and given depth, by a dialogue process, in which members of the public and the Society's machine learning Working Group were brought together to discuss the implications of this technology. A series of dialogue events in Birmingham, Huddersfield, London, and Oxford, ranging in time from several hours to two days, provided a space where people could find out about machine learning, ask questions, share opinions, and develop their views. Through a series of case studies, participants could see the practical applications of machine learning, and deliberate about how it could be used in the future. The dialogues explored uses of machine learning in health, social care, marketing, transport, finance, policing, crime, education, and art.

What does the public think about machine learning?

One of the clearest messages from these public dialogues is that the public do not have a single view of machine learning; attitudes, positive or negative, vary depending on the circumstances in which machine learning is being used.

Most people had not heard the term 'machine learning' – only 9% of those surveyed recognised it – but the majority had come across at least some of its applications in their day-to-day life. For example, 76% of respondents had heard about computers that can recognise speech and answer questions, as found in the virtual personal assistants available on many smartphones.

The significant potential of machine learning was clear to many, not least because of its connection to the world of 'big data' and its ability to analyse data. In analysing this data, participants suggested that machine learning could:

- be more objective than human users, or help avoid cases of human error, for example avoiding issues which may arise where decision-makers are tired or emotional;

- be more accurate, for example in detecting features of disease in medical images and making accurate diagnoses;

- be more efficient, particularly in terms of public sector resources and shaping how services were delivered;

- offer opportunities for new businesses, and economic growth across a range of sectors; and even

- play a role in addressing large-scale societal challenges, such as climate change or the pressures of an aging population.

People could therefore see machine learning improving how services work, saving time, and offering meaningful choice in an environment of information overload.

Concerns about machine learning and its applications fell into four themes:

- the potential for machine learning systems to cause harm, for example as a result of accidents in autonomous vehicles;

- the possibility that people could be replaced by machines in the workplace, or could become over-reliant on machines;

- the extent to which systems using machine learning might make experiences less personal, or human, either by changing the nature of valued-activities, or by making generalised predictions about an individual; or

- the idea that machine learning systems could restrict the choices open to an individual, for example directing consumers to one type of product or service.

Each of these areas is currently being addressed by areas of active research – such as validation and verification, robustness, or human-machine interaction – and progress in these areas could help increase public confidence in the deployment of machine learning systems.

People's views on particular applications of machine learning were often affected by their perception of who was developing the technology, and who would benefit. They were, for example, almost uniformly positive about the potential for machine learning to help doctors, and hence improve healthcare.

What does this tell us?

Before the Royal Society's machine learning project, little was known about what the public think about machine learning. The questions raised during this public dialogue exercise offer insights into how to create the conditions for rapid and safe delivery of the potential benefits of machine learning, while managing any associated risks.

There is a broad range of views amongst the public, including dissonant views on the same topic or question. The public saw most to be gained where machine learning could be used to augment human abilities, or do things humans cannot, for example providing advanced analysis.

At its core, this dialogue exercise shows that the public do not have a single view on machine learning. Attitudes towards this technology – whether positive or negative – depend on the circumstances or application in which it is being used. This context is key, as the nature or extent of public concerns, and the perception of potential opportunities, are linked to the application being considered.

Read more about the Royal Society's work on machine learning in the report *Machine learning: the power and promise of computers that learn by example*.

The Royal Society is a self-governing Fellowship of many of the world's most distinguished scientists drawn from all areas of science, engineering, and medicine. The Society's fundamental purpose, as it has been since its foundation in 1660, is to recognise, promote, and support excellence in science and to encourage the development and use of science for the benefit of humanity.

The Society's strategic priorities emphasise its commitment to the highest quality science, to curiosity-driven research, and to the development and use of science for the benefit of society. These priorities are:

• Promoting excellence in science

• Supporting international collaboration

• Demonstrating the importance of science to everyone

For further information
The Royal Society
6 – 9 Carlton House Terrace
London SW1Y 5AG

T +44 20 7451 2500
E science.policy@royalsociety.org
W royalsociety.org

Registered Charity No 207043