Blog

Using Machine Learning to Transform Medical Practice and Discovery

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Following her Turing lecture on how machine learning can revolutionise medical practice, in this blog interview, we ask Turing Faculty Fellow Mihaela van der Schaar to share her vision for data-driven medical discovery.

How can machine learning technologies support medical care?

A great deal of current medical practice is not driven by data but rather by the experience of the individual physician or hospital. Machine learning makes it possible to drive medical practice by the enormous volume of evidence that is becoming available. This is leading medical practice to become much more objective, systematic and consistent. At the same time, machine learning also enables medical diagnosis, prognosis and treatment to be *personalised* to the individual patient.

Machine learning will also help physicians, nurses and clinical staff to make correct decisions and decrease the incidence of medical errors.

How will doctors work differently in 10-15 years' time?

Machine learning will augment the performance of medical personnel by analysing available data, presenting it and suggesting

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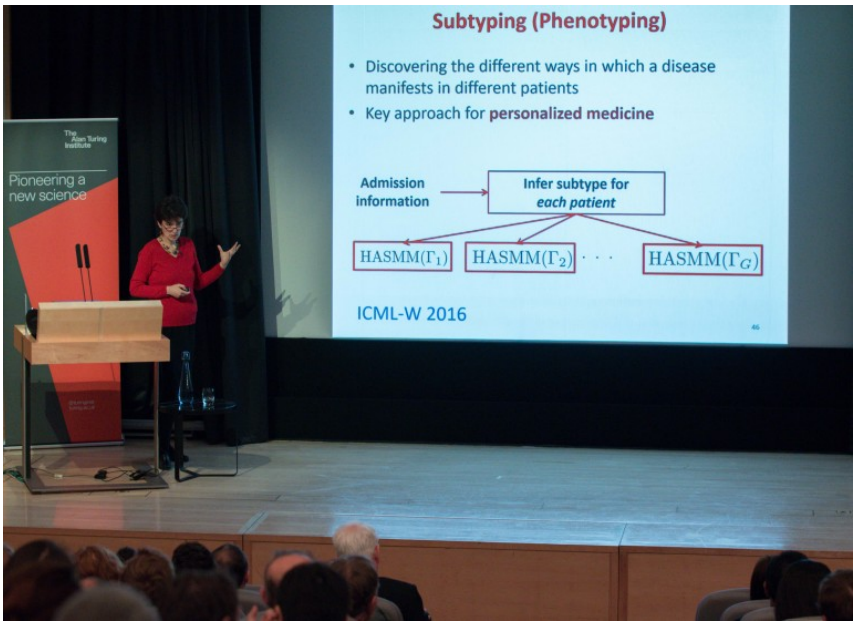
a course of action. The physician will no longer have to rely on one-size-fits-all



clinical practice guidelines. Instead, she will interact with computerised decision-support systems that will advise – but not dictate – about every aspect of her practice: the tests that should be performed, the way the results of those tests should be interpreted, the course of treatment that should be followed for the individual patient being examined.

In some cases, she will have expert advice that a particular patient is at extreme risk and must undergo specific procedures and treatments now - without waiting for the onset of symptoms after which it might be too late – and conversely, that another patient, in an apparently similar situation, can safely be simply monitored.

Machine learning can also be an invaluable tool in training medical personnel, by providing personalised education, accounting for the enormous diversity of abilities, backgrounds, interests and needs. Because machine learning can personalise instruction to the needs of the particular student and evolve with the student, it can also be an invaluable tool in enabling practising clinicians to keep abreast of advances in medicine.

How can machine learning techniques be used to improve medical diagnoses of serious diseases, for example, cancer?

December 2015
November 2015
August 2015
June 2015
January 2015

Machine learning will help us to identify those patients who are at greater risk and hence need to be monitored and screened more actively and more often and hence cancers will be detected much earlier, at a point where the cure is much more likely.

Machine learning will enable us to determine individualised treatment effects and hence to predict with much greater confidence which treatments are best for which patients. For example, at the moment, there are more than half a dozen different chemotherapy regimes in widespread use against breast cancer – but no one knows which regime is most likely to be effective for a particular patient at a particular stage of the disease.

Moreover, physicians will all have access to the best clinical decision support systems, so more patients can be assured of the highest quality care.

What are the biggest challenges in transforming medicine through machine learning?

The biggest challenges to this process are assembling, aggregating and integrating the data from many and diverse sources, turning this data into actionable intelligence, and then helping clinicians to understand that machine learning is their friend – not their competitor.

How will the Alan Turing Institute support this endeavour?

The Alan Turing Institute is uniquely positioned to bring together the expertise and knowledge base of computer scientists, engineers, mathematicians, statisticians, medical researchers and clinicians to make a revolution in medical care.

Announced last week is a new partnership with Cystic Fibrosis Trust, which I will be leading, and which aims to use data from cystic fibrosis patients to create a method of generating personalised risk scores. These scores can then be used by people with cystic fibrosis and their clinical teams to tailor treatments and other activities to effectively manage the condition.

To hear more from Michaela about how machine learning can transform healthcare, watch her Turing Lecture *Data Science for Medicine*. *Using Machine Learning to Transform Medical Practice and Discovery.*

Turing Lecture: Data Science for Medicine

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