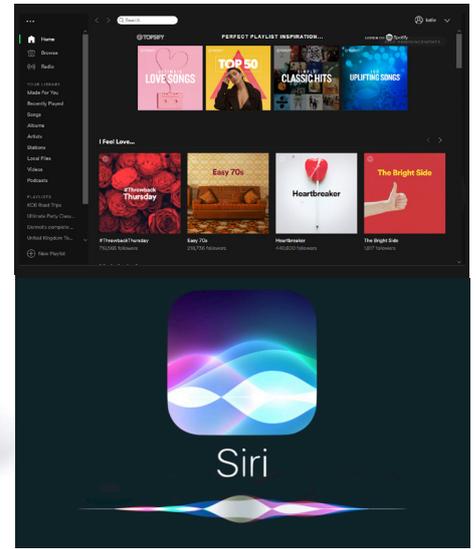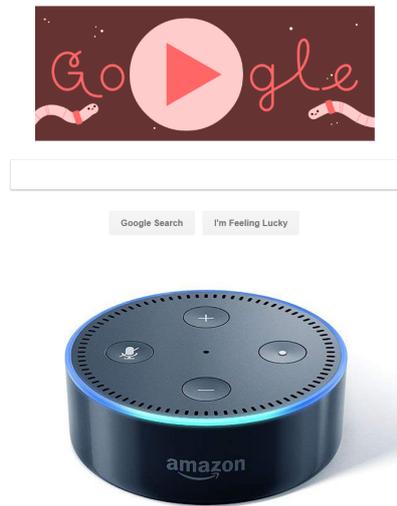# AI - the perfect teacher's assistant

Combining the latest AI technology with the unique 'human touch' of good teachers can transform the classroom - helping to level the educational playing field and save valuable time and resources!

What is AI?
AI in School.
Algorithms and Reading.

Lexplore

HMRC, Google, Spotify and Facebook all use AI to make their services more personal.

AI in our day to day lives

Artificial intelligence (AI) might still seem like a science fiction concept, but we actually interact with this futuristic technology every day without even noticing! Listening to music, shopping online, dealing with banks, and now also in classrooms.

News about AI enabling for the quick diagnosis of illnesses and aiding in the fight against cybercrime can make it seem that we are on the cusp of a new age of technological discovery. However, the same advancements which are being embraced by technological giants like GCHQ and the NHS, have actually been having a profound and much more understated impact on our day to day lives for years.

Although we might feel in total control of our online activity – AI is frequently making decisions for us! Think of all the times you have discovered a great book or song from a recommendation given by Spotify or Amazon. Have you ever considered these are based on complex algorithms which tailor online services for us?

Perhaps much more significant is the impact that AI has had in transforming the way in which the financial service industries operate. As it has a superior ability to process huge amounts of data and identify patterns of activity, which might elude most human beings or computer programmes, AI has enabled banks to precisely monitor the thousands of transactions made every second.

Without AI it would be almost impossible for our banks to study individual spending patterns and provide immediate alerts for any suspicious and possible fraudulent activity. In fact AI is constantly watching over our accounts, and providing automatic and instant alerts in the fight against online fraud.

Although AI is having a hugely positive impact in our day to day lives, the mention of such technology in education is still likely to bring the unwelcome image of robot teachers to mind!

However, at Lexplore we utilise AI's ability to spot patterns of progress, to help children become better readers and identify those having difficulties with learning. In the following guide we explore how AI can transform the classroom, creating an equal educational playing field and contributing to an improved school environment.

What is AI?

What is AI and Machine Learning? How are they different? And how have these concepts developed since their phrases first came into existence in 1956? Although those original pioneering scientists could only have dreamt of the AI technology we have available today, we still remain very much on the cusp of what is technologically possible.

AI in History

Although the phrase 'Artificial Intelligence' was first adopted in 1956 by American computer scientist John McCarthy , the idea of intelligent machines has fascinated scientists and philosophers for centuries.

In fact, British scientist Alan Turing is often regarded as a pioneer in the development of machines able to converse with humans. In successfully cracking the enigma code using his Bombe Machine, he set the foundations for future research, and increased fascination into the possibility that machines could use information and reason to solve problems and make decisions as humans do.

Developing Intelligent Machines

Following McCarthy's Dartmouth Conference, Artificial Intelligence officially became a field of academic study. Researchers from across the globe began collaborating to explore the possibility that they could give machines intelligence, and resolve complex tasks without any need for human cognition.

Although artificial intelligence is all around us, it is still a dynamic and ever improving field of scientific research. Today, it has become a much more umbrella term, which encompasses multi-disciplinary fields of research with many different subareas.

Machine Learning (ML)

Machine learning is not only one of these branches, but perhaps the one we actually interact with most. In fact, it is a common misunderstanding that AI and ML as phrases are interchangeable.
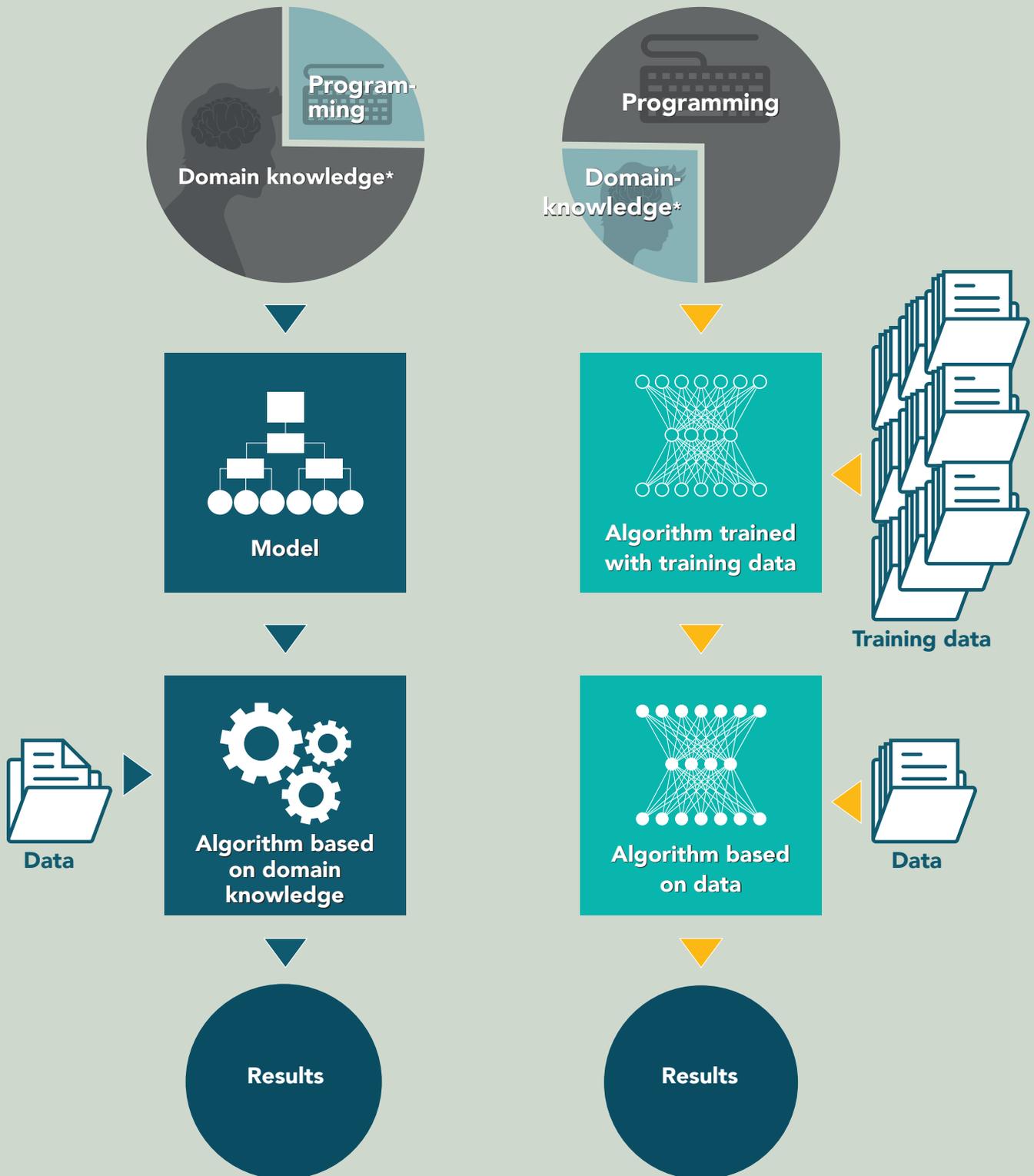
Machine Learning is actually a sub area within the field of AI, that refers to machines which can learn from their interpretation of data, and draw conclusions for themselves rather than following set rules, as in AI.

Together, AI and Machine Learning enable us to instantly learn from the analysis of large amounts of data, in a capacity which exceeds what is humanly possible. IBM's Watson computer system is able to mine and perform a complex analysis on 200 million pages of text in just three seconds.

In Healthcare, such technology has revolutionised patient care by providing the data driven information professionals need to personalise treatment plans and options. The same benefits can also be reaped within the classroom!

Traditional programming

AI (Artificial Intelligence)

Program-ming

Domain knowledge*

Programming

Domain-knowledge*

Model

Algorithm trained with training data

Training data

Data

Algorithm based on domain knowledge

Algorithm based on data

Data

Results

Results

* Domain knowledge refers to knowledge of the environment in which a system operates. AI has a superior ability to process huge amounts of data and identify patterns of activity in an instant and much more accurate way than most human beings or computer programmes.

Saves time and resources

Data driven instructions

Personalised learning

AI in School

When it comes to providing assistance, AI is already having a transformational impact in the classroom helping to level the educational playing field and save valuable time and resources.

The school environment is extremely complicated! Teachers work tirelessly to provide children with the best opportunities. However, it is no secret they are coming under increased pressure; balancing the need to improve social mobility with day to day challenges and increased budget cuts.

Technologies, such as AI, have the potential to provide educators with new tools to fill gaps in the education system, personalise learning, and drive whole school efficiency. By combining the power of AI with the unique 'human touch' of good teachers, schools can work to provide their students with equal opportunities to excel, whilst also reducing the challenges encountered by teachers.

Reading in schools

It is widely recognised that strong literacy skills provide the foundations for a successful education. Not only do they enable children to access the wider curriculum, but also introduce them to a world of literature, where they can learn to deal with complex emotions and read for pleasure.

When it comes to learning to read, it is often assumed children will naturally develop the skills they require. However, unlike acquiring language, these skills are not inbuilt. Instead, children must learn the many complex cognitive and linguistic processes involved in deciphering text for themselves.

Children with good memories will remember and recognise the sequence of letters in words, but for some children, this is a much more difficult task. For those who manage to develop coping strategies and hide the fact they are struggling, their problems can become worse and even more difficult for teachers to spot and support.

A new way of working

At the moment the traditional combination of paper-based tests and teacher assessments, which many schools use to test literacy are riddled with pitfalls. They do not assess the full range of complex process involved with reading, and require endless marking which takes up valuable teaching time. Artificial Intelligence is the type of technology which could really make a difference!

Based on established and peer-reviewed research into the relationship between reading and eye movements, Lexplore Analytics have developed algorithms able to determine a child's reading level and highlight those experiencing potential difficulties in minutes!

Objectivity is Important

AI analysis is able to provide teachers with an entirely objective insight into how effectively the main cognitive processes related to reading work together.

The subjective nature of current assessment methods can make it especially difficult for teachers to determine the attainment of those performing at borderline levels. However, with new technology able to circumnavigate many of these problems, Lexplore Analytics can help teachers confidently pinpoint those requiring extra support and provide the evidence-based information they need to tailor interventions individually.

The Research Behind

Although Lexplore Analytics' new method of assessing reading combines some of the latest technological developments, it is actually based upon 30 years of academic research. In fact, their AI analysis bases itself upon an in depth research project carried out at the Karolinska Institute in Stockholm, which selects the Nobel Laureates in medicine.

The deductions Lexplore Analytics' founders made during their study of the Kronosberg project, which led to the development of the assessment method used today, were published in PLoS One (Benfatto et al., 2016) and confirmed following later research.

How does it actually work?

Although the research and technology behind the assessment can sound incredibly complicated, the method itself is as simple as it is effective!

A child reads two short passages of text and answers some simple questions. Algorithms then perform a powerful statistical analysis based upon individual eye movement patterns and audio recordings.

The results are then instantly available in Lexplore Analytics' user-friendly portal. Each child is given a percentile score, a reading age, a year level equivalent and a standard score. Eye movement and audio recordings are combined to offer teachers a unique visualisation of each child's silent and oral reading process.

Comparisons can then easily be made over time, between students, national averages, classes, and even schools within the same Local Authority or Multi Academy Trust.

An individual measurement is also given for each of the individual components and displayed alongside previous results. This enables teachers to monitor even the most minor progress at a granular level.

Algorithms and Reading

A bit like spaghetti and tomato sauce we cannot have artificial intelligence without algorithms! But what exactly are algorithms? And how on earth can they be trained to determine reading attainment?

What is an algorithm?

Quite simply, an algorithm is just a sequence of instructions, almost like a recipe. They describe what should be inputted: olive oil, onions, garlic, and crushed tomatoes…and what steps to take: chop 2 onions, crush 1 garlic clove, fry the onion in 1 tablespoon olive oil, pour in a can of tomatoes and so on. The result is in this case - tomato sauce.

A more mathematical example of an algorithm that everyone once learned is division. It consists of a number of steps that you have to go through to get to a result.

The algorithms used in machine learning and artificial intelligence are similar, the input and the instructions, however, are much more complex!
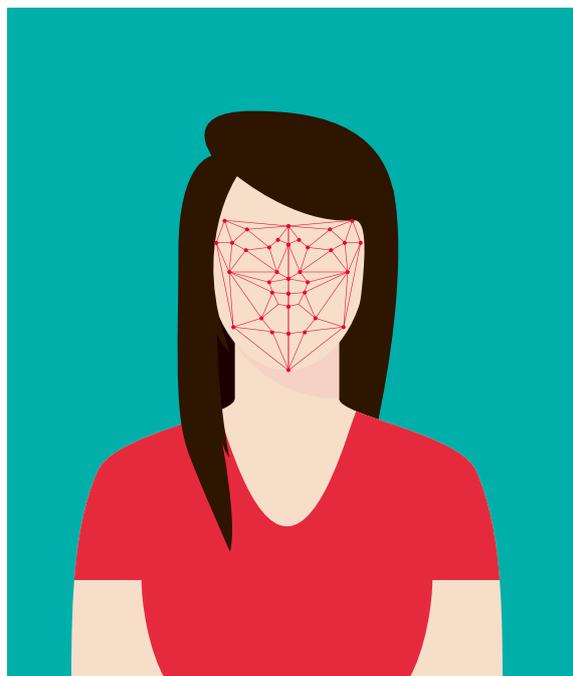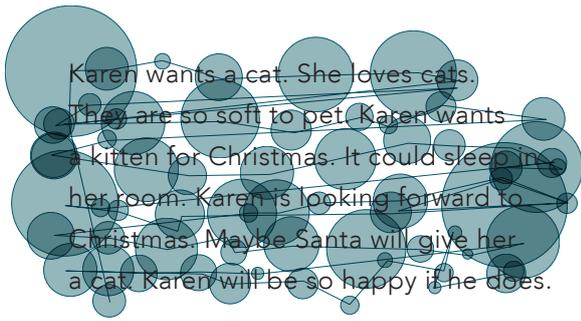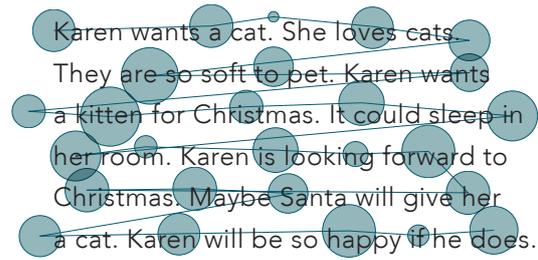

Training Algorithms

Algorithms need to be trained to perform the variety of complicated calculations required to answer different questions.

One example would be to ask a machine, "Is there a face in this picture?". An algorithm to answer that question needs to take a digital representation of the image and calculate whether there is a face in the image or not. Lexplore instead asks the question "What is the reading level of this student based upon their spontaneous eye movements whilst reading?"

Machine Learning carries out a specialised programme of analysis, which can adapt when encountering new questions based upon previous information.

**Eye movement recording from pupil with low reading attainment**

Eye movement recording from pupil with a high reading attainment

Algorithms and Lexplore

Lexplore Analytics' machine learning models produce algorithms for assessing eye movement data. These follow steps of analysis to determine reading attainment. They have been trained based upon the Kronosberg Project and original data from around 3000 pupils. Their eye movements and reading ability was measured through a variety of traditional tests.

Lexplore Analytics' algorithms have been trained to automatically make links between specific eye movement patterns and reading attainment. Such training involves lengthy processes of identifying and quantifying connections. Following careful validation and properly executed training, the algorithms used for the assessment today are able to identify these correlations and immediately determine reading attainment to a high degree of accuracy.

Training of Algorithms

Training data

Algorithms

New data

Results
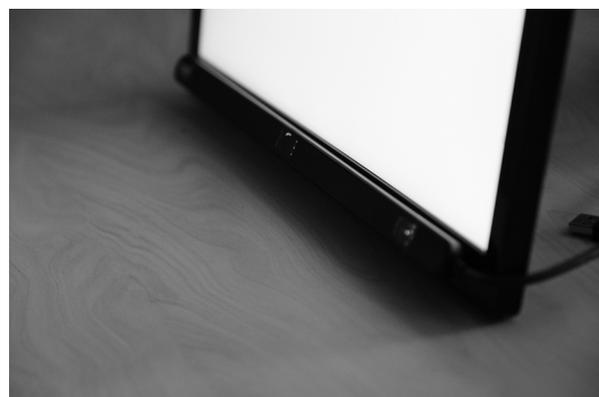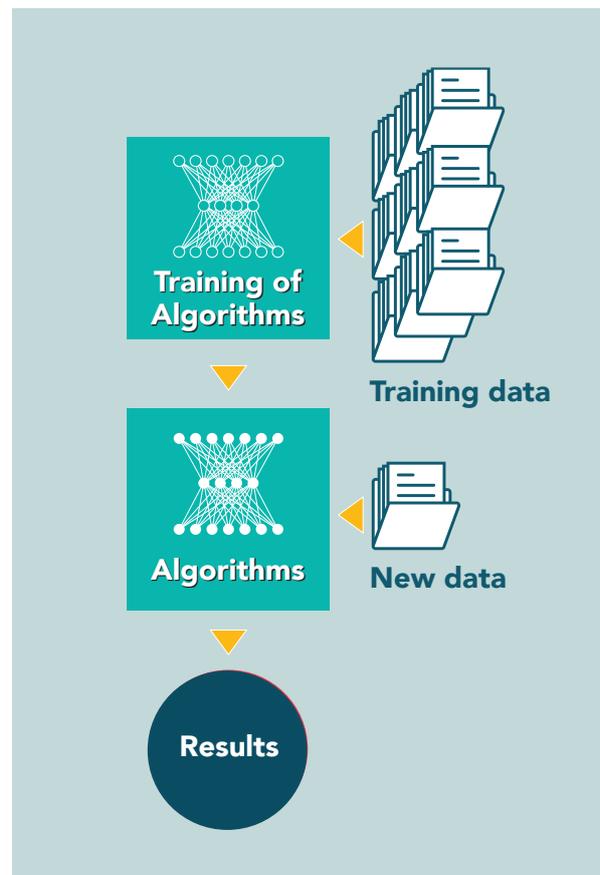
The students read two short texts on a screen, and an eyetracker records their eye movements.

How can AI determine reading attainment from eye movement patterns?

AI algorithms are trained on thousands of students' eye movement recordings when reading, as well as upon results from a mixture of assessments testing word chains, rapid naming and non-words.

Rapid naming

Word Chains

Non-words
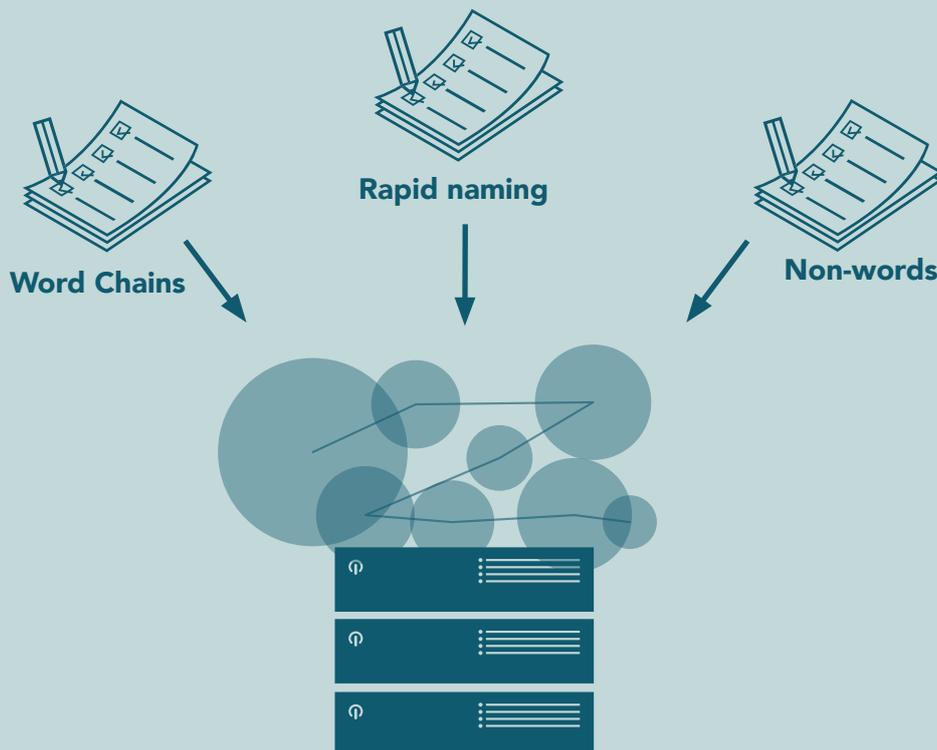
Our machine learning platform performs a powerful statistical analysis based upon correlations between thousands of eye movement recordings

35
need
support

High

Low

Average

Objective and accurate results are presented in Lexplore Analytics' user-friendly portal

The Future of AI

AI is already having a hugely positive impact in the classroom helping to streamline the assessment process and reduce teacher workload. Our ambition is to give teachers more time to do what teachers do best and encourage all children to develop that all important love of reading!

Although it is evident that embracing artificial intelligence within all areas of society has many far reaching benefits, future use and development remains a controversial topic. Media headlines reporting that AI, in the form of robotics, will take 800 million jobs by 2030 simple exacerbate the fear many have that in embracing technology we will create a dystopian version of society.

However, in reality technological advancements are not only set to change our society for the better, but also create as many, if not more jobs than they replace. The UK tech sector is in fact growing 2.6 times faster than the overall economy, and with London now ranked the second most interconnected location for tech companies behind Silicon Valley, the industry is set to become one of the UK's biggest employers.
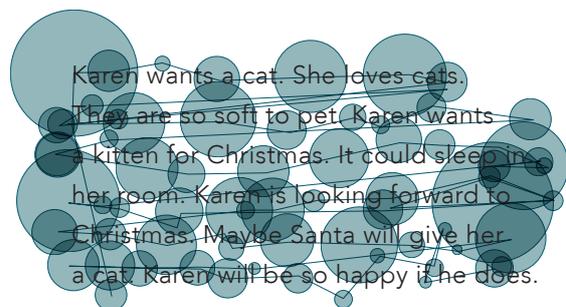
Robot Fears in Education

Although the mention of AI in education does for many still bring the image of robot teachers to mind, algorithms will certainly never replace the invaluable skills a good teacher brings into the classroom. However, there are many exciting ways AI can already help schools spot patterns of progress, especially when it comes to reading.

As discovered by Jayne Mullane, Headteacher at Mersey Vale Primary, artificial intelligence can have a hugely positive impact on pupils' reading, and offer teachers a different perspective when it comes to classroom assessments.

The introduction of Lexplore Analytics' AI assessment into their classrooms has enabled Mersey Vale's teachers to obtain the valuable information they need in minutes, without the need for administrative input adding to their workloads.

From the pupils' point of view, the assessment is also fun, enjoyable and interesting. Readers of all levels have loved doing the tests, and it has made for a welcome change from the written assessments they are used to for both students and staff.

Karen wants a cat. She loves cats. They are so soft to pet. Karen wants a kitten for Christmas. It could sleep in her room. Karen is looking forward to Christmas. Maybe Santa will give her a cat. Karen will be so happy if he does.

Making a difference

One of the main benefits AI brought to Mersey Vale was that the technology helped give them invaluable, new information.

"The eye tracking assessment was able to reveal one of our pupils had not previously been identified as having reading difficulties, because she had developed advanced coping strategies to manage them. She had strong verbal skills and was very capable, and we assume that she had been using images and other cues such as context to help her understand text."

Such difficulties cannot be hidden from the machine!

"By targeting intervention specifically to the needs of the child, the progress she has made since her first assessment has been impressive within such a short period. As her coping strategies were so highly developed, it is worth considering how long it would have taken for us to gain the same information with regular, paper-based assessments."

Future development

We live in an exciting age! Advancements in AI – combined with the traditional know-how of our teachers – can help children develop the reading skills they need as the cornerstones of their educational journey.

Perhaps one of the most impressive things about this technology is that fact that it actually learns from the data it collects. Therefore, the more it is used in schools the more accurate a picture of reading it is able to give! AI really can have a transformational impact in the classroom, helping create an equal educational playing field, and contributing to an improved school environment for every pupil and teacher.

More data   **Better Algorithms**
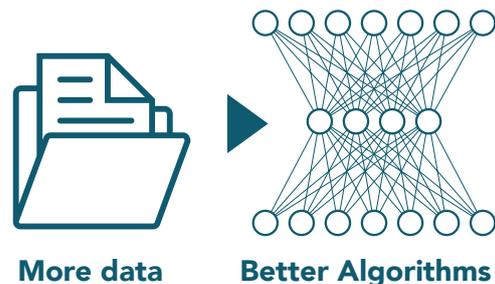
# Programmes utilising Artificial Intelligence

Watson

Originally a computer system created by IBM to answer questions for the quiz show Jeopardy! It's ability to analyse 200 million pages of text in just three seconds has seen is embraced by those in Healthcare. The system is now undergoing development to learn how to diagnose illnesses like Cancer.

AlphaGo

AlphaGo was the first computer program to beat a person in the board game Go.

Eliza

Eliza was an early chat robot that was developed in the mid-1960s. Although, she was originally developed without artificial intelligence, Eliza was one of the first computer programmes able to process user inputs and engage with a response by following the rules and directions of her script.
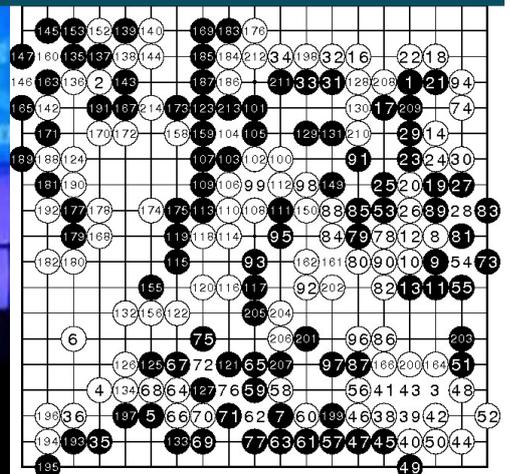
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Welcome to

    EEEEEE  LL      IIII  ZZZZZZZ  AAAAA
    EE      LL       II        ZZ  AA  AA
    EEEEE   LL       II       ZZZ  AAAAAAA
    EE      LL       II      ZZ    AA  AA
    EEEEEE  LLLLLL  IIII  ZZZZZZZ  AA  AA

 Eliza is a mock Rogerian psychotherapist.
 The original program was described by Joseph Weizenbaum in 1966.
 This implementation by Norbert Landsteiner 2005.


ELIZA: Is something troubling you ?
YOU:   Men are all alike.
ELIZA: What is the connection, do you suppose ?
YOU:   They're always bugging us about something or other.
ELIZA: Can you think of a specific example ?
YOU:   Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here ?
YOU:   He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed
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About Lexplore Analytics

Lexplore is a pioneering and mission-driven company, which provides schools with new technology and resources to promote reading development.

At the core of our offering is a ground breaking method of measuring reading attainment, which uses artificial intelligence and eye tracking technology to offer an entirely new insight into literacy.

By measuring when, where, and how a student's eyes move in relation to the words they are reading, our paperless assessment quickly analyses a their skills across key reading components, determines their attainment, and highlights potential barriers in a matter of minutes.

With immediate, fully objective and in-depth results, teachers can then work with our dedicated intervention package to support both emerging and fluent readers in their development.

Lexplore