Media Analytics

Conor Joyce - 19425804

In our lecture Dr Suzanna Little came in to talk to us about media and specifically media analytics. She talked about the uses and benefits of analysing media and also the challenges faced in regards to this.

What is media?

Media comes in many forms, for example images, audio, and video. These forms of media are what we all experience everyday but games and animation are also included in the wider umbrella of media. It is through different mediums such as youtube videos, audio files and blog posts that we perceive media itself. Then we have different modes for understanding this information, such as our sense of hearing for audio files and music, and sight for videos and images.

What is media analytics?

Media analytics is using different forms of media and analysing them to gather information, which can be used for a lot of different applications such as medical use, security, and collecting analytics e.g. tv ratings, social media impact, etc.

Analysing media has a lot of benefits, especially in our technologically advancing society today, but also has its own challenges. For example, when analysing visual media, we need to understand the difference between visual and semantic similarity. Different images could look the same but have completely different meanings behind them, and the opposite applies also - different images could look different but actually be describing the same thing.

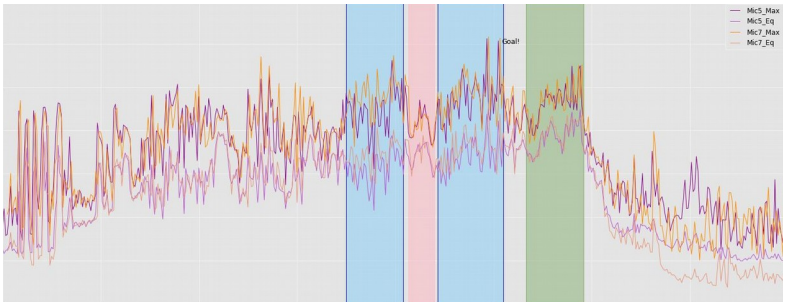
- For example these three images look similar, yet describe completely different things.

Smart Stadium project

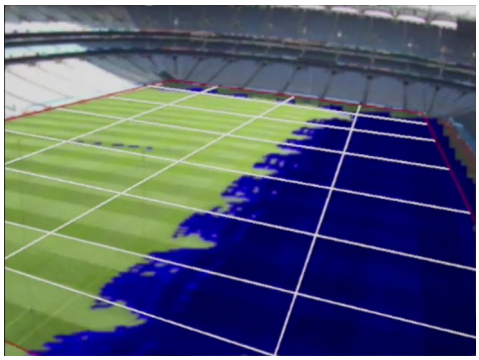
A big use for media analytics is the Smart Stadium project in Croke Park. Essentially, Croke Park is at the moment being used as a "testbed" for sensors and different IoT technologies.

Some of the applications in use currently in Croke Park include:

- Analysing noise levels at matches - multiple mics around the stadium output the noise level in dB, which is then processed to increase the accuracy of the data, which can then be used in graphs and analytics.



- Monitoring grass growth - collecting images of the pitch and analysing them, monitoring light levels and water on the pitch. Image processing of the pitch to define light and shade regions on the pitch helps understand how the grass is growing and helps with maintenance of the pitch itself.



Teaching computers to "see"

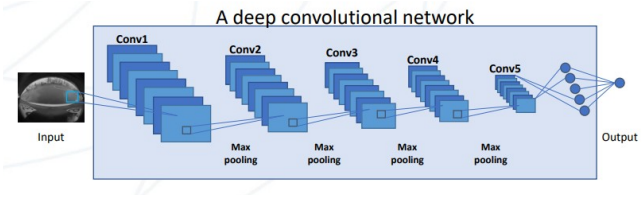
Teaching computers how to effectively analyse images and understand what they are seeing is an important aspect of the Smart Stadium project and is useful for other applications also such as smart cars, movement of crowds, and identifying objects in an image.
One of the big challenges in regard to this is the fact that a lot of input data is required before computers can even start understanding visual media effectively.

This challenge in particular has been mitigated immensely in recent years due to the rise in deep learning mechanics and optimization of "big data" collection and analysation, and because of these, improvements have been made and using computers to analyse images in much more commonplace nowadays.

Deep Learning and Big Data

Deep Learning is a form of machine learning, and uses neural networks to process a huge amount of data. Through this process it is possible for computers to effectively "learn" to do certain things, with complex algorithmic processes generated by feeding a neural network lots of input data.
Deep Learning has progressed immensely in recent years because of the availability of more powerful hardware and advances in "big data" processing.

"Big Data" is the collection and use of huge amounts of information, which is used in neural networks and analytics. Dealing with this amount of data has been a big issue in the past, but advances in deep learning have helped progress this field, both fields effectively benefiting the other's development.



Big Data is also used in huge technology companies such as Facebook and Google for analytics, advertising and optimizing of their websites and services. For example YouTube uses around 15-20 terabytes of data every single day, so improved technologies for dealing with this data is very important

Final Thoughts

Overall I found Dr Little's presentation very engaging and interesting and her presentation skills were evident throughout. She interacted with the students and didn't just read off the slides like a lot of people presenting fall into the habit of doing, which helped a lot with keeping the attention of students.

I also found the topics around Deep Learning and the Smart Stadium project in Croke very interesting. It is clear these technologies have a huge impact and will only continue to affect our lives even more are they advance and become more complex and accessible to everyone.

Design Thinking

Conor Joyce - 19425804

In our lecture, Dr. Peter Robbins came in to talk to us about businesses and the challenges businesses face currently, specifically innovation and being ahead of the competition.

The business world right now

The biggest challenge for businesses today is innovation and being ahead of other companies. For example, a young, talented company with a better idea could come along any time and affect your market share. A startup with a better idea and better user experience can ultimately take over your niche and your users can move to this new and improved product.

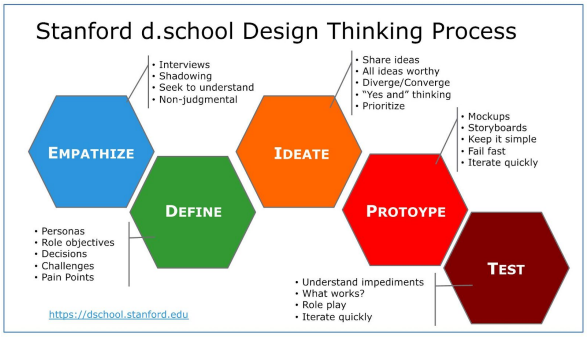
In the presentation, Dr. Robbins showed us the statistics showing that 84% of CEO's do in fact believe that innovation is the biggest challenge facing their business at the moment and that only 6% of CEO's believe their company has the people and the know-how to win at innovation, and overcome these newer startups.

What is going on in most businesses?

This hyper-competitive situation businesses find themselves in nowadays is called the "VUCA" environment. VUCA stands for "Volatility, Uncertainty, Complexity, and Ambiguity", and basically explains the fact how in the business world today, things change so fast, and it hard to predict what is going to happen. That's why it is important for businesses to analyse what is going on with themselves and their competition so they can have an advantage.

What is design thinking?

Design thinking is a process for coming up with new ideas. It encourages businesses to design things with users in mind and other competition. Foreseeing the future and understanding the outcome of different products helps create new and better products.



How expensive is failure?

Failure in innovation is very common in businesses, more so than success. The financial cost of failure is also massive. For example, Dyson recently cancelled their project on an electric car that they spent 4 years and $3.5 billion and 250 engineers had been working on this also.
Another example is Google Glass, this technology was ahead of its time and estimates on how much Google spent on this is $650 million. This ultimately flopped despite its technological advancements.

Tesla has also dealt with this very recently with their Cyber Truck. Tesla has put so much money into research and the development of this product. It is to be the most advanced truck ever made, with armoured glass and also features their top-of-the-line smart car technology. But on the day of the reveal, Elon Musk - the CEO of Tesla - was demonstrating the strength of the cars windows, and how it could stop a bullet. He threw a rock at the window and it smashed into a million pieces in front of the whole world. Musk laughed this off slightly saying how clearly more work had to be done before launch but the effect of this on the companies global opinion and reputation has harmed them still.

Innovation in Ireland

Innovation in Ireland is currently in a crisis. Many businesses are struggling as of this also. Irish SMEs (Small and Medium-sized Enterprises) at the moment have a low innovation intensity and innovation productivity, which causes them to struggle in the modern global market.

The Irish government is trying to counteract this by increasing the rate of business startups, increasing productivity growth in SMEs, encouraging more female entrepreneurs, encouraging young and migrant entrepreneurs, scaling up to more medium-sized firms, and increasing SME activity in foreign markets.

Right now there is a weakness in SME management skills, a lack of investment, slow technology adoption, and a reluctance to seek external advice. So the work the Irish government is doing to try and counteract all this will hopefully help a lot.

Final Thoughts

Overall I found Dr. Robbins' presentation very interesting and it gave me an insight into the business world, something I had little to no interest in before. He was an engaging presenter and talked about his slides instead of just reading them, giving context and a more entertaining presentation.

It is clear that modern businesses are in an ultra-competitive environment and this drive for innovation will only help us as a society advance ever faster into the future in terms of technology and new breakthroughs.

Building the Hydrogen Economy

Conor Joyce - 19425804

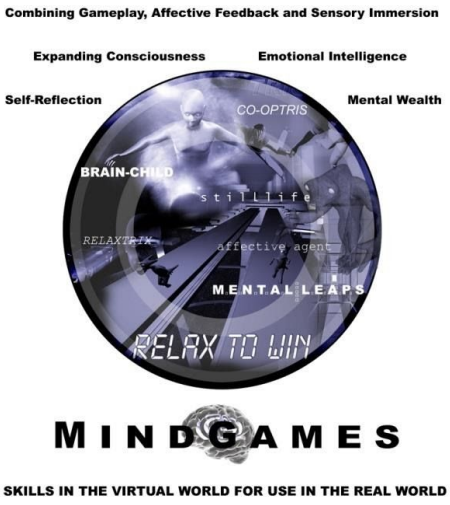
In our lecture, Dr. Gary McDarby came in to talk to us about innovation in technology and combating climate change specifically by using hydrogen as a source of energy instead of fossil fuels, doing this requires innovation in the energy sector.

Volunteer work in Liberia

In 1992, Dr. McDarby visited Liberia in West Africa as a volunteer, as the nation was suffering due to civil unrest and a military coup. He showed particular interest in a boy named Prince who suffered from severe trauma from what he had witnessed growing up at this time in Liberia. Prince's trauma was so bad that he was unable to sleep at night, Dr. McDarby had a Sony Walkman at the time and gave it to Prince which helped him immensely to relax and to sleep also. It was at this time Dr. McDarby realised the impact technology can have on people's lives.

Career

After finishing his PhD, Dr. McDarby helped set up the MIT Media Lab in Dublin in 1999. The lab focused on researching the human impact of technology. Out of this, he created and led the MindGames group, a group consisting of talented engineers, designers, psychologists, computer scientists, and artists. This group focused on gaming and how to combine it with biomedical engineering and psychology. They developed a game, designed to help people learn how to relax. This then evolved and was commercialised as a Bluetooth biosensor using the same 'Relax to Win' concept.



The Computer Clubhouse

Dr. McDarby also convinced the Media Lab to setup a clubhouse on its campus, where young people from the community could get access to technology, and learned how to use different tools from the workers in the Media Lab. This space encouraged learning, innovation, and helping the youth build on their own interests.

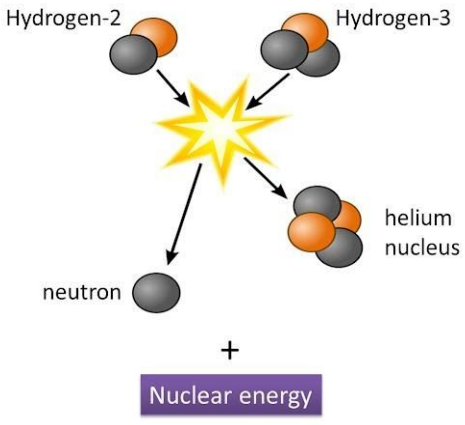
The Hydrogen Economy

Dr. McDarby spoke about climate change and the biggest factor contributing to that right now is an excess of CO2 emissions around the globe. Our dependence on fossil fuels as a source of energy is a main cause of this, therefore we need a new clean and powerful energy source. Using hydrogen is one potential solution.

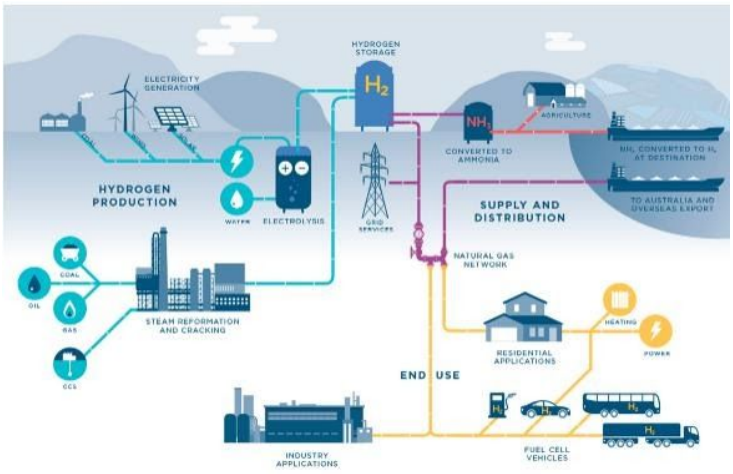
Hydrogen is the most abundant element in the universe and stars use hydrogen along with nuclear fusion to create energy, if we could learn to effectively do this, we would have the "ultimate clean energy source". Dr. McDarby explained how batteries, electrolysis, and hydrogen fuel cells work, and the potential for using gas canisters full of hydrogen instead of natural gas which is commonplace at the moment.

How to get hydrogen

There is only a small amount of hydrogen in the atmosphere so the best way to collect hydrogen is through electrolysis of water. This is done by running an electrical current through ionised water, separating it into its two elements - hydrogen and oxygen. This requires power though so a solution is to use renewable energy sources such as wind and hydroelectric power to extract the hydrogen. At the moment a lot of renewable energy is wasted, for example, at night it is usually windier, so it is when wind turbines generate the most energy, but it is also when demand is at its lowest, so using this energy to extract hydrogen is a great way of storing and making effective use of this power.



Uses for hydrogen



Hydrogen can be stored in gas canisters which can be used by cars, lorries, buses, ovens, and heaters. Using it as a fuel for flight is also very effective as it extremely light compared to regular aeroplane fuel, and it has zero carbon emissions. The side products from making hydrogen fuel cells are water and heat so these can also be used for households around the globe. Fuel cell cars, in particular, are a very promising concept and already some of these vehicles have been invented by car companies such as Hyundai, Honda and Toyota.

Other benefits of hydrogen

The use of hydrogen as a main fuel source in the world has many other economic and sociological impacts. This would massively reduce our carbon footprint and help stop climate change before it becomes too late for us. Also with easy access to an immense about of energy, it could greatly benefit developing countries, giving them access to technology and resources they couldn't have before. The development and advancement of these countries will also end wars and increase their standards of living immensely

Final Thoughts

Overall I found Dr. McDarby's presentation very interesting, especially because of the topics he spoke about. I have a keen interest in science and found the hydrogen economy concept very interesting and he explained everything and how it worked very well. The topic of climate change is also one of the most important issues in the world today so a good plan to combat this is very beneficial and interesting to me.

It is clear that advancements need to be made and more effort and resources put towards solving the problems in our society, and the benefits of using hydrogen as a energy are obvious, it's economical and sociological advantages cannot be ignored and I can only hope it can become a possibility in the future.

Insight Research

Conor Joyce - 19425804

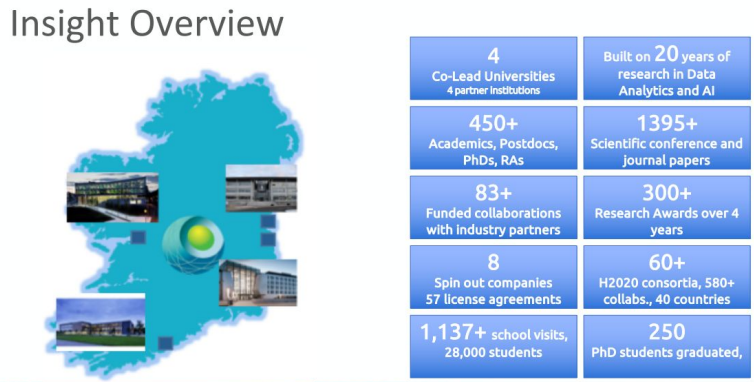
In our lecture, Dr Aoibhéann Bird came in to talk to us about the Insight Research Centre, and the work they do in regards to data analytics. Dr Bird is the Education and Public Engagement Manager at Insight, and during her presentation showed us what they did, with a focus on smart technologies and their uses in sport and health.

The importance of data

In our ever-advancing society today, it is clear that data is a very important asset to have. It has both positive and negative uses, a negative one, for example, is the Chinese government's control over their population using facial recognition and a social scoring system.
Despite this, there are many positive uses for data such as in sports research, health, and businesses also. An example of this is how health agencies analyse Twitter keywords to preempt and track outbreaks of norovirus and the flu.
Overall data, and good data analytics, can help further us as a society and make our lives easier.

The Insight Centre for Data Analytics

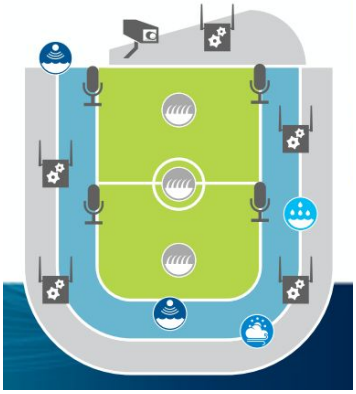
According to its website, The Insight Centre for Data Analytics is a joint initiative between researchers at DCU, NUIG, UCC, UCD and other partner institutions. Insight brings together more than 400+ researchers from these institutions, 100m+ funding, and with over 80+ industry partners, to position Ireland at the heart of global data analytics research.



The Insight Centre has worked in areas such as Multimedia Analysis, Artificial Intelligence, Human Performance, and Biosensors.

Sports Analytics

Dr Bird spoke of certain aspects of analytics in sports, including Exciting Event Detection, Shot Type Classification, Team Behaviour, Scoreboard Detection, and Sport Preservation. The Smart Stadium project in Croke Park also contributed to this, as The Insight Centre were also involved in this. Croke Park is used as a testbed for different IoT and smart technologies, which includes analytics. Projects specific to the Smart Stadium project and which have been tested and used to great success in Croke Park include Sound Monitoring, Crowd Behaviour, Pitch Monitoring, and Flood Management.



Technology in the Health sector

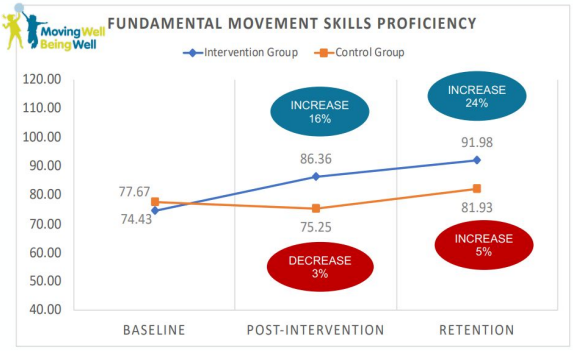
Dr Bird also spoke of wearable technologies and their benefits towards health and analytics in regards to this. She spoke of wearable sensors for people with neurological diseases such as Alzheimer's and how they can help. Interacting with Alzheimer's patients using Lifelogging technology helps provide memory assistance and address cognitive problems.

Another example is the SwEatch device, which can monitor sweat composition in real-time, specifically sodium and other analytes in sweat. This helps with monitoring athletes and their abilities and analysing what happens to their bodies when working out or under stress.

Moving Well Being Well

Dr Bird also spoke about the Moving Well Being Well initiative by Sport Ireland and the benefits of physical exercise in children. According to the WHO, Ireland is to be the most obese nation in Europe by 2030, which is a frightening prediction. The Moving Well Being Well initiative assessed 2,148 children across Ireland in 44 different schools. They took measurements in multiple areas such as Muscular Strength, Cardiovascular Endurance and Fundamental Movement Skills.

This initiative held a study based on this with two groups, an intervention group and a control group. The intervention group showed very encouraging results with a 16% increase in movement skills and a 24% increase in skill retention. The benefits of being physically active, especially for young people, cannot be understated.



Final Thoughts

Overall I found Dr Bird;'s presentation very interesting, and her focus on sports had me very engaged during the presentation. The benefits that technology can bring into this area and in health also is amazing and I'm sure this can only improve everyone's lives immensely, especially in the future.

Smart technologies and IoT devices are slowly creeping into our everyday lives, and as someone who is very interested in technology and its impact on people, I look forward to seeing what other advancements will be made and what the intelligent people working with organizations like The Insight Centre can come with.

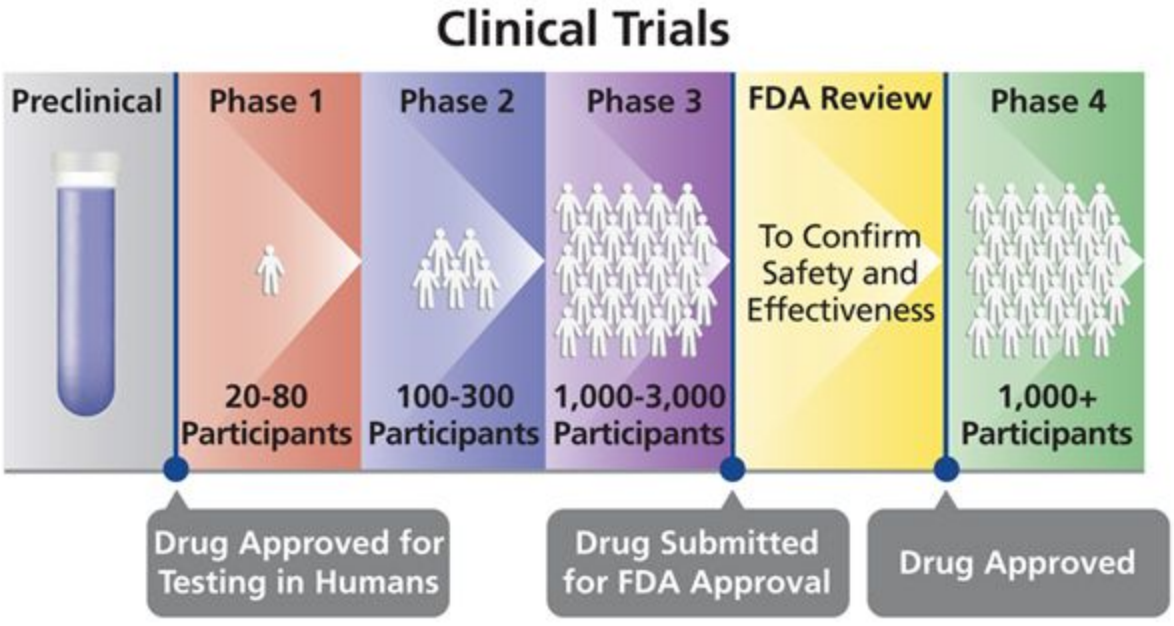
Innovation in Clinical Research

Conor Joyce - 19425804

Dr Willie Muehlhausen talked to us via a video presentation about Clinical Research and innovation in this area. Dr Muehlhausen has been working with CRO's (Clinical Research Organizations) for many years and was previously the head of innovation in one such CRO. This is very relevant at the moment with the current coronavirus outbreak and Dr Muehlhausen used this as an example throughout his presentation.

Clinical Trials

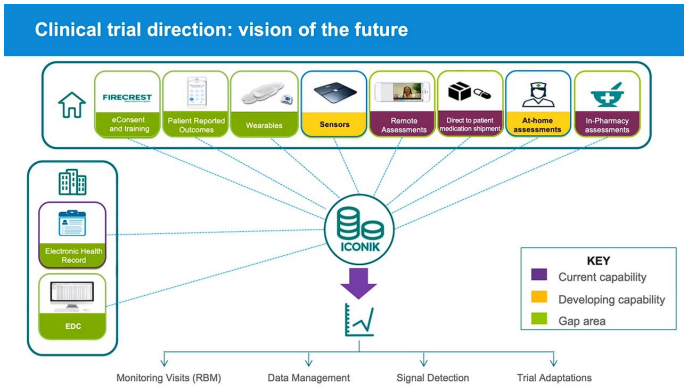
Clinical trials are the process of testing new drugs or vaccines before they are deemed safe for the public and widespread use. First, they are tested on animals before being tested on humans and this is where clinical trials come in. Clinical trials come in phases where more and more testing is done to ultimately find out how safe a certain drug or vaccine is. There are hopes that a coronavirus vaccine will enter phase 1 of clinical trials sometime this year.

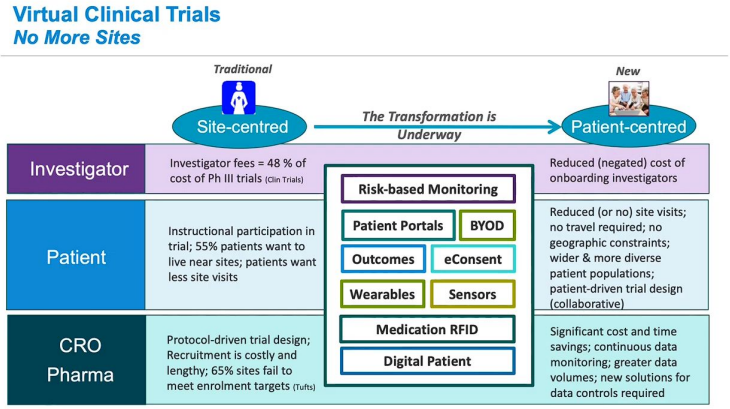


Here is a diagram showing the different phases of clinical trials, and you can see how slowly but surely a drug is assessed/tested and eventually approved for mass use on patients.

Virtual Clinical Trials

Dr Muehlhausen talked a lot about the idea of Virtual Clinical Trials and this will affect the future and certain aspects that have already been implemented. One such aspect is the idea of remote assessments with a patient's GP, via video calling for example. This is already very popular and even more so with the coronavirus outbreak. Other aspects of this that are currently in use include direct-to-patient medication shipment, sensors for gathering data, and at-home assessments also.





The focus on all of this is to ease the patient's burden when undergoing a clinical trial. In the past, patients have to visit a doctor very often for prescriptions and assessments but now patients can take part in a clinical trial mostly from the comfort of their own homes.

Challenges

Currently, only a few of the above-mentioned aspects of virtual clinical trials have been implemented. Of course, new technologies have challenges and the rapid development of technologies such as machine learning and advancements in data analytics have helped immensely.

Research Challenges & Strategy

Challenges	Strategy
Changing device and vendor landscape	Monitor existing and emerging vendors via Consortia (i.e. HealthXL, Wearable Technology AG)
Medical device vs. consumer device	Ongoing Research project to determine validity of data from consumer products
"New" endpoint development	Work with network in Academia to use existing knowledge to support POC projects
"Raw" actigraphy data files are massive	Testing technologies that allow us to analyze raw data in the "cloud"
Signal detection	Ongoing Research project with our inhouse data analysts to develop a procedure to detect signals
Operationalization	Use our eCOA PMs who have experience with Actigraphy projects and work with Validic and Medidata for data processing and storage
Lack of Standardization	Potential collaboration with German TUEV on data standardization Establishment of an Actigraphy Vendor Consortium similar to the ePRO Consortium

One challenge in this field is a lack of standardization, and Dr Muehlhausen spoke of this and how there are plans for a group to come together to help combat this thankfully. Other challenges include new endpoint development, and the ever-changing device and vendor landscape.

Final Thoughts

Overall I found Dr Muehlhausen's presentation very interesting, and the topic of clinical trials and how they work is fascinating to me. It is clear that these are very important in advancements in the medical industry, especially at times like these with a novel deadly virus wreaking havoc on the world.

This sector obviously has a huge impact on the world and the health of the billions of people on earth. Improvements in this area to help speed up and make clinical trials easier will only benefit society as a whole and the improvements we currently see in this sector are amazing to see.

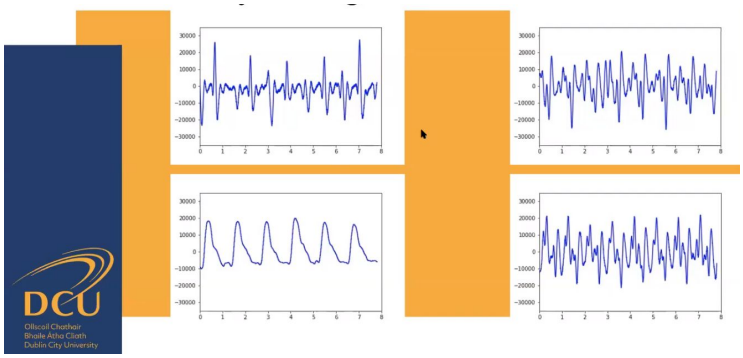
Human Activity Recognition

Conor Joyce - 19425804

Dr Tomas Ward talked to us via a video presentation about Human Activity Recognition in wearables and the challenges faced in this area. Dr Ward is our lecture in DCU and also the AIB Chair of Data Analytics at the School of Computing in DCU. He also does a lot of work with the Insight Research Centre for Data Analytics.

Monitoring Human Activity

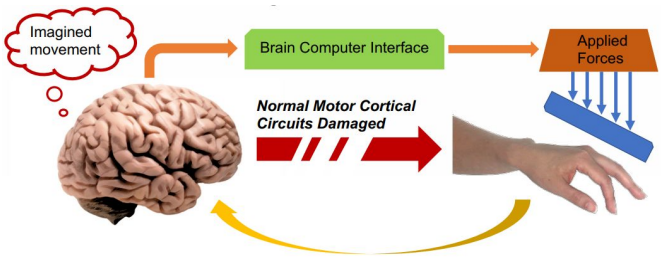
This can be achieved easily with wearables such as Fitbits and smartwatches for example. These wearables have an optical sensor which gives out light and measures how much light is reflected back. This can then show a person's heartrate.



The issue with these is that everyday use of the device can cause interference. For example, moving your wrist a lot will cause the wearable device and its sensor to move around a lot, lowering the accuracy of the data received.

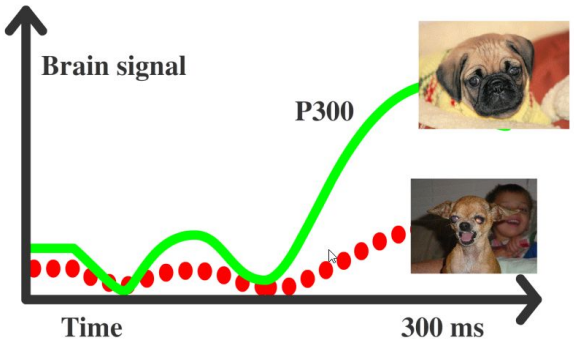
The solution to this is Machine Learning and Data Analytics. Through this, we can identify patterns within the data and improve the data's accuracy and improve our understanding of the data, for example, whether a person is walking, running or at rest.

Stroke Rehabilitation



People who have suffered from a stroke end up with an immense difficulty with their motor skills, so Dr Ward along with some researchers came up with the idea to bypass the brain and instead use a computer interface to control different parts of a person's body.
A person would just have to think of moving and the computer would recognize this and act accordingly. This is extremely useful in stroke rehabilitation and allowing people to use their body's to their full potential again.

P300



P300 is the name of a specific brainwave that occurs in response to a person spotting a target among a set of distracting stimuli. This has many uses and is very beneficial in attention training. An example Dr Ward used was a game where a person would be shown different images and have to "spot the pug". Whenever a person saw a pug, their P300 brainwave spiked, so how quickly they do this can be measured. With Machine Learning, we can automate brain signal extraction and in this instance specifically the P300 brainwave which can be then used to create specific training to enhance a person's P300, effectively training and improving their attention.

Final Thoughts

Overall I found Dr Ward's presentation very interesting, the topic of stroke rehabilitation, and how this can be done with neural interfaces and machine learning, fascinated me. I think this is really important research and the benefits of this at present and in the future are very clear and I'm sure this technology will improve people's lives greatly.