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ANIMATION SCRIPT

DATA AND COMMUNICATION IN THE WORLD OF THE FUTURE

PROFESSOR JUSTIN COON

TO MAKE THE MOST OUT OF THIS SCRIPT, YOU COULD:

- Stick it in your book as a record of watching Justin's animation
- Pause the animation and make notes as you go
- Add your own illustrations to the sheet
- Create your own animation to accompany it
- Add notes from classroom discussions
- Make notes of areas you will investigate further
- Make notes of key words and definitions
- Add questions you would like answered – you can message Justin through the comment box at the bottom of his article: **futurumcareers.com/data-and-communication-in-the-world-of-the-future**

SCRIPT:

What comes to mind when you think about engineering? According to Professor Justin Coon, engineering can be thought of as the process of applying physics and mathematics to solve a problem through design and ingenuity.

Justin heads the Information and Network Science Lab in the University of Oxford's Department of Engineering Science.

His team is exploring electrophoretic molecular communication, graph compression, the value of information, and network security.

ELECTROPHORETIC MOLECULAR COMMUNICATION

Justin's team is investigating the use of molecules to transmit information from one point to another, in the same way that cells use molecules to communicate with each other.

However, there are good reasons why we have tended to use electrical communication, including radio waves, rather than molecular communication within the machines and infrastructure we build.

Just like tea diffusing in cold water, most molecular communication systems operate very slowly through diffusion.

To solve this challenge, the team is working on using electric fields to propel information-carrying molecules to different parts of a communication system.

Electrical communication is currently the best option for electrical systems, but electrophoretic molecular communication could prove useful in non-electrical devices such as biomedical implants.

GRAPH COMPRESSION

There is a huge amount of data in the modern world – so much, in fact, it can be difficult to know what to do with it.

Graph compression involves encoding datasets so that fewer binary data or bits are used.

For example, think about the first line of Jingle bells. If we want to 'compress' this into fewer letters, we can represent it as A B, A B, A C D E – where A = jingle, B = bells, and so on. As long as whoever is sent the compressed version knows the code, all the data are still there.

Of course, data are far more complex than Jingle Bells, so Justin's lab is developing a tool for the visual representation of graph compression algorithms. The aim is to reduce data complexity to something manageable for basic smartphones or laptops.

VALUE OF INFORMATION

With so much data available, there needs to be a prioritisation system in place. For example, sensors are deployed to measure pollution levels, temperature, traffic and so on.

The information generated by these sensors is communicated to computers where the data are processed, but not all the information is high-value.

Justin's team is working on developing ways to quantify which data should be communicated, to help computers process and react to information as efficiently as possible.

NETWORK SECURITY

Tanmayee Deshprabhu is a PhD student in Justin's lab, whose research investigates how to provide security for future communication networks.

The 'Internet of Things' involves devices communicating with each other. For example, washing machines and fridges connecting to our smartphones or traffic lights connecting to CCTV cameras.

Without a central hub that can oversee these interactions, this interconnectedness could be exploited maliciously, putting people at risk.

Tanmayee is using machine learning to build classification tools, which use information about past attacks to identify patterns that can predict and pre-empt future attacks.

Her aim is to allow the individual components of the Internet of Things to independently carry out their own risk assessments.

The wide-ranging research conducted in Justin's lab shows that studies in engineering and communications can be incredibly broad and fascinating.

What could you achieve as an engineering scientist?