IBM Research - Ireland

IBM Research – Ireland is part of a global network of 12 labs working together to use science and technology to transform business and the world. Together we are testing new technologies on real business problems and growth opportunities. Some of our current research includes:

- ❖ **Cognitive Integrated Care:** A digitally integrated care management system for patients
- ❖ **Connected Cars:** A context-aware in-car reasoning system
- ❖ **Cognitive Operations:** Self-aware buildings that learn and adapt to behaviour
- ❖ **Edge Computing:** Computing infrastructure at the edge for IoT
- ❖ **Automated Argumentation:** Building computer systems that can form an argument
- ❖ **Cognitive Analytics:** Building cognitive systems which can assist humans to make smarter choices
- ❖ **Cognitive Sales Team:** Solution for building the appropriate sales team to drive opportunities forward
- ❖ **Applying AI to Drug Discovery:** Artificial Intelligence-driven discovery of chemical synthesis
- ❖ **Cognitive Rail:** Reducing operational costs in rail through Cognitive IoT
- ❖ **Protecting Data:** Creating tools for identifying and protecting privacy vulnerabilities.

IBM RESEARCH – IRELAND AT A GLANCE

Lab Director: Wendy Belluomini

Location: IBM Technology Campus, Dublin, Ireland.

We operate in a multidisciplinary environment involving IBM scientists, industries and universities. In 2015, we opened a collaboratory with University College Dublin and we are involved in many joint projects including European Union Horizon 2020.

For more information

http://www.research.ibm.com/labs/ireland
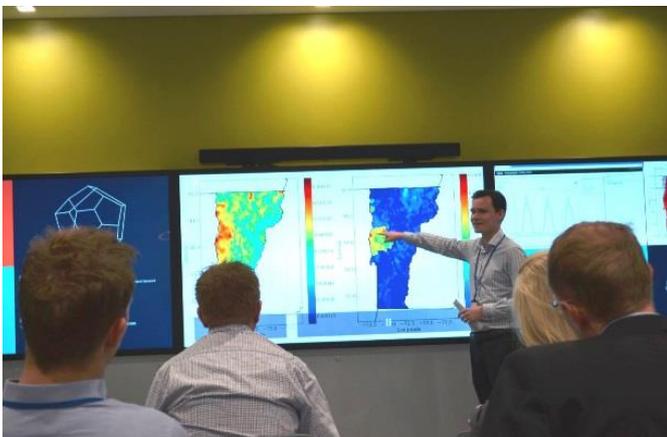
RESEARCH AREAS

Cognitive Integrated Care

70-80% of healthcare costs in the European Union are spent on chronic diseases. This corresponds to a staggering €700 billion. 50 million people in the EU live with multiple chronic diseases, which have a significant negative impact on their quality of life.

We are helping to build an IoT framework that will be combined with information from medical devices and a series of caregiver applications. This information will be processed using IBM cognitive analytics and provide a consolidated view of the individual, ultimately creating a digitally integrated care management system for patients with chronic diseases. In turn, this view will be used to drive behavioural change and improved patient outcomes.

Connected Cars

Context-Aware In-Car Reasoning System -"Genie"

[Gartner](#) forecasts that by 2020, there will be a quarter billion connected vehicles on the road, enabling new in-vehicle services and automated driving capabilities. During the next five years, the proportion of new vehicles equipped with this capability will increase dramatically, making connected cars a major element of the Internet of Things (IoT).

Cars are undergoing a huge transformation: From mobility devices with the single purpose of getting people from an origin to a destination to becoming interconnected, intelligent and informed devices, which can be used to deliver shared services. This disruption in the automotive industry creates opportunities for connected car and collaborative mobility, services delivered to and from cars and the optimisation of urban transportation networks. Technologies from distributed control, optimisation, signalling and stochastic modelling of dynamic networks are key to developing these novel mobility concepts and shared services.

As one example, together with University College Dublin, IBM Research – Ireland is developing a context-aware in-car reasoning system. This system constitutes a cognitive personal companion, that debates and reasons with the driver, and mitigates personalised risks for the car. It is envisioned that the companion will become a fundamental core technology for future connected and autonomous cars.

Cognitive Operations
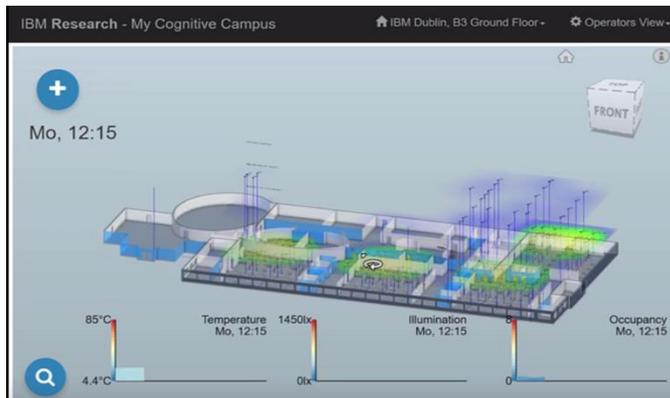
Cognitive Campus "Fluid Spaces" Use Case View

Cognitive buildings are able to integrate IoT devices autonomously and learn about the behaviour of the system and its users. They have evolved to learn and adapt actively, making them aware of their own energy performance and balancing it with the comfort of its occupants.

Our "Cognitive Campus" project builds on IBM's Watson IoT platform. It drives predictive maintenance and integrates new kinds of immersive virtual and augmented reality interfaces with eight cognitive IoT use cases for groups of buildings or campuses. These use cases are being tested on several buildings, including a data centre with more than 3,000 sensors, at the IBM Technology Campus in Dublin, Ireland.

Edge Computing

The Internet is evolving from an infrastructure where data is aggregated in centralised data centres to an infrastructure where data is distributed in servers located closer to the data sources known as "edge computing". We are building a universal microserver architecture and software ecosystem which will address the challenges of performance, power consumption and reliability in cloud data centres and emerging edge computing markets.

In today's cloud data centres, physical systems comprise individual server units that contribute processing, memory, accelerators and storage resources. The challenge is for these resources to be more efficient, flexible and agile. We are developing a vertically integrated "data centre-in-a-box" prototype to showcase the superiority of disaggregation in terms of scalability, efficiency, reliability, performance and energy reduction.

Automated Argumentation

IBM Research is ushering in a new era of Cognitive Computing through our debating technologies project. IBM Researchers in the Haifa, India and Dublin labs are developing algorithms that can assist humans to reason, make decisions, or persuade others. Specifically, this multi-year cognitive computing project explores decisions scenarios where there isn't only one correct answer. Through computational argumentation techniques, we have demonstrated the ability to generate pro and con arguments for a given topic by drawing from a given body of knowledge (e.g. Wikipedia).

For more information

http://www.research.ibm.com/labs/ireland

Cognitive Analytics

In Dublin, our Cognitive Analytics Group focuses on how cognitive systems can assist humans to make smarter choices using techniques such as Recommender Systems, Network Analysis, AI and Data Mining for decision support. This team are currently working on cognitive sales analytics and intelligent compliance monitoring.

Cognitive Sales Team

The Cognitive Sales project harnesses the complex network of client organisations and the expertise of sellers and teams to assist in identifying clients, provide an enriched understanding of the client and products of interest along with a solution for building the appropriate sales team that can work together to drive the opportunity forward.

Applying AI to Drug Discovery

When chemists design a new drug, they not only need to design a target molecule or compound, but they also need to look at the reaction pathways to synthesise that target molecule or compound. Providing an automated solution to reaction pathway discovery is not a trivial task, and has yet remained unsolved; So, instead has been done manually. It is a time-consuming, repetitive task that can result in sub-optimal solutions or even failure in finding reaction pathways due to human error.

Our scientists see this challenge of drug discovery as an important way to help chemists discover reaction pathways and chemical reaction sequences for generating target chemical components. Artificial intelligence-driven discovery of chemical synthesis could have a wide-ranging impact across not only the pharmaceutical industry, but also food, chemical, and materials industries.

Cognitive Rail

Our researchers are helping rail operators to use big data predictive analytics to reduce operational costs through pre-emptive maintenance. Terabytes of data collected from a rail operator's trackside sensor network are processed on a big data analytics cluster with an algorithm that incorporates both the knowledge of experienced rail engineers with the innovative application of machine learning methods to predict when a train part is expected to fail days in advance of actual failure. This allows maintenance to be scheduled at a time and place that has the least impact on cost and rail operations, ultimately providing a better service to rail customers.

Protecting Data

Organisations, public bodies, institutes and companies gather enormous volumes of data that contain personal information. For reputation, compliance and legal reasons, the personal information needs to be de-identified before being shared with third parties, such as analytics teams or research scientists. It is often the case where the data owners cannot fully understand how vulnerable their datasets are in terms of privacy and what strategy they need to follow to provide the necessary level of protection. Our scientists have developed the technology to identify and protect privacy vulnerabilities, provide recommendations for data release processes with the end goal to automate, to a high degree, the decision-making process for data owners.

We Are Hiring

At IBM Research, we continuously strive for excellence and build technical leaders who will define the future of technology and our industry for many years to come. Currently we are hiring for new research and software engineering positions which can be found on our website.

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