Horizon Scanning Series

The Effective and Ethical Development of Artificial Intelligence: An Opportunity to Improve Our Wellbeing

Agriculture

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In the past two weeks, I have been thinking of the questions carefully and would like to provide some opinions and comments to the Group for consideration.

1. An overview/discussion on the relationship (and importance) of this sector as it applies to artificial intelligence;

Since the 1950s, AI has been playing an increasing role to the world scientific and engineering research, applications, and producing also an increasing impact to almost all aspects of the governments in the world and our daily life. In particular, since 2016 when Alpha Go defeated the world champion, AI has been very hot.
USA, China, UK and EU as well as many other countries have made out their National AI Strategy and/or investment plan. From this point of view, Australia and NZ are a bit behind, so it is necessary to speed up and make either joint ANZ AI strategy or separate National AI Strategies in Australian and NZ. It is no doubt that AI is very important to Australia and NZ and the two countries will need to make strategic plans in AI including investment.

While it is natural to make a joint AI Strategy in Australia and NZ given our close relationship, we will need to recognise and at least notice the different between Australia and NZ in AI. If the decision is to make a joint ANZ strategy, then we need to make sure NZ is not disadvantaged as Australia has different strengths and focuses from NZ AI research and applications.

2. Current and recent advancements in this area both locally and internationally;

Both Australia and NZ have been recently demonstrating great developments in a number of areas. In particular, Australia has successfully hosted IJCAI 2017 in Melbourne, NZ will host IEEE CEC 2019 in Wellington, and ANZ researchers have been discussing to bring GECCO to Australia/NZ. Compared with Australia who has a much larger and wider number of areas in AI research, NZ has a relatively small number of areas that are either playing international leadership roles or have international reputation in the recent years, including

- Automated and Evolutionary Deep Learning (CNNs, Auto-encoder, non-NN based deep learning, etc.)
- Evolutionary Computation and Learning, particularly Genetic Programming and Learning Classifier Systems
- Feature Selection, Feature Construction and Feature Learning and high-dimensionality Reduction
- Modern Planning and Scheduling, particularly dynamic supply chain including scheduling, routing, resource allocation and combinatorial optimisation
- Transfer learning and domain adaptation
- Image and vision computing
- Statistical and mathematical learning
- Open source software (such as WEKA, and R)
- Spark Neural Networks
- Text/Web mining and natural language processing
- AI in Agriculture (Seafood, milk industry, wine industry, etc.)
- AI in law
- AI in manufacturing industry (Supply Chain)
- AI in Big Data and Data Science/Data mining

National wide, NZ has a number of large AI research groups/centres:

- VUW has a large AI research group/centre with about 50 researchers (13 academic staff members, 7 postdocs and >30 PhD students)
  [https://www.victoria.ac.nz/research/strengths/research-focus/artificial- intelligence]
- AUT has an AI research group with over 15 researchers (staff and students)
- Waikato has a AI group of 15 researchers (Weka)
- Otago has an AI on public policy research centre/group (mainly on Law, public policy and humanities and social sciences)
- all other universities such as Auckland, Canterbury, Lincoln and Massey have a number of AI researchers.

NZ AI researchers have been very active in participating international AI events, and hold many important positions in international journals and conferences (ARC/ERA Tier A*/A venues).

3. **What are the gaps in Australia/New Zealand as it relates to AI (and how this may compare internationally);**

Compared with USA, China, UK and EU, Australia and NZ are small. A major gap between ANZ and the world major AI countries is the national AI strategy and government investments. While USA, China, UK and EU have very clear AI strategy and invest a huge amount of funding, ANZ (particularly NZ) has not had a clear strategy and investment.

Australia is much ahead of NZ in AI. To date, NZ even does not have a single AI (and even ICT) platform or CORE. This is very risky, which will place NZ in a very disadvantaged position when competing with other countries. In addition, the Marsden Fund, MBIE Smart Ideas and research programs, NSC/SfTI, James Cook Fellowship do not have a clear category in AI or even ICT. These aspects should clearly be strengthened.

Another major gap is AI people training. Currently, NZ salary is a bit low compared with other countries, and it is hard to attract top AI people to work in NZ. On the other hand, many young students would like to take an AI major or specialisation as well as Masters and PhD in AI, but the staff members in AI in NZ are not sufficient to train enough students for our NZ industry. The gaps in both the number of high-quality academics and number of students in both undergraduate and postgraduate levels exist, which should be improved.

4. **What will the next 10 years bring for Australia/New Zealand (i.e. where do you see the field heading and what opportunities or risks will this provide to AI)**

Prof Zhi-hua Zhou from Nanjing University (…) visited VUW in Feb and a group of people had a great discussion on the next 10 years of AI research and impact.

In terms of the next 10 years, if our government can make proper investment, I believe AI will play a major role in NZ research and applications:

- Automated and Evolutionary Deep Learning
- Evolutionary Computation and Learning, particularly Genetic Programming and Learning Classifier Systems
- Feature Selection, Feature Construction and Feature Learning and high-dimensionality Reduction
- Modern scheduling, routing, resource allocation and combinatorial optimisation

- Transfer learning and domain adaptation
- Image and vision computing
- Open source software (such as WEKA, and R)
- AI applications in Agriculture (Seafood, milk industry, wine industry, etc.)
- AI applications in big data and supply chain

Although our law and employment communities are a bit nervous or fear of AI development, the risk of AI replacing human experts in those areas is small --- if we take an "weak AI" approach (instead of "strong AI").

5. **Considering the international perspective and advances in the field, what resources will be required to realise this potential (e.g. skills, training, infrastructure, international collaboration, regulation).**

In NZ, I think we need to take serious actions to use AI to serve us and benefit us:

- The Central Government needs to make a National AI Strategy
- The Government (MBIE/TEC,etc.) needs to invest AI research and encourage the companies (industry) to collaborate with and invest universities and CRIs, establishing a national AI platform or CORE to help this development
- The Government should encourage and support NZ universities to establish AI majors and specialisations, particularly in the postgraduate levels --- to train more AI young people
- We should make international collaborations particularly with USA, Australia, China, UK, Singapore, Canada to use their resources to serve us
- We should perhaps also make regulations to stop "automatically" apply AI tools in certain areas such as in law, privacy, etc.

It is also important to note that many of our colleagues would like to learn UK or other countries to make NZ focus on AI application or industry. While I agree the applications and industry (particularly primary industry) is important to NZ, making NZ AI research focus on applications or industry (or sometimes called "challenges" areas is dangerous. We all know that UK is very strong in fundamental research (even stronger than USA), so most of the AI colleagues in UK universities are actually doing fundamental research very well. So it is natural for the UK government to set up applications or challenges for further investments --- the UK Turing Institute is designed for this purpose. In NZ, however, this is not the case at all. We are quite weak in fundamental research with international reputation, and many people are doing application/industry research. Accordingly, we must keep a good balance --- put enough investment on fundamental research to make NZ internationally reputed, using which we train our (postgraduate such as Masters and PhD) students, then make them serve our industry. In the next 10 years, this will be very important. If we missed the fundamental research in AI, we will essentially lost the momentum for growing AI related industry.