What it means to be a young CI researcher in the 21st century

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You are at a friend's party and the inevitable question arises *"What do you do?". It may be* an everyday question but for highly technical fields, such as Computational Intelligence (CI), it can be tricky to answer. To reply with something like *"AI research into ...",* appreciating that CI would sound alien, can lead your new pal, perhaps your next date(!), to contemplate the likes of Skynet and ASIMO. Although there are exceptions, it is quite uncommon for our CI research to be as tangible as this, albeit fictional applications. When I studied CI as an undergraduate it dawned on me just how important communicating effectively is for articulating ideas and concepts. And this does not exclusively apply to all parties!

"Nature inspired problem-solving" is a succinct phrase that neatly sums up what the CIS is really about. The drive of the CI community is to create a tool set of nature inspired concepts and methods underpinned with theoretical foundations for tackling a diverse range of difficult problems. For young CI researchers, this is a great challenge as it requires a broad level of knowledge combining areas of nature, like biology and psychology, with foundational principles of computer science such as algorithms and data structures, and also mathematics. A long list of subject areas to cover but thankfully I can still remember subjects from school and so I allow myself to reacquaint with the required depth of knowledge.

Identifying links between real intelligence and computational models is an exciting adventure that demands creativity and patience. An aspect I particularly enjoy, when confronted by the right situation, is observing a natural phenomenon or a beautiful behaviour revealing itself right before my eyes. Although, my humble experiences have not led to anything so stimulating as ant colony optimisation or swarm intelligence. It is this appeal of discovering such a link between nature and computation that initially lured me into the field of CI. With a diverse range of areas that tantalise our taste buds, we are spoilt for choice with the likes of tribal fuzzy logic talk [1] and evolving neural network ensembles [2].

As young CI researchers we play a crucial role in the direction of future CI research and it is our duty to contribute to this aim. Questioning existing approaches in well-established fields develops our knowledge further. But I feel one of the greatest contributions of young researchers is the opportunity to explore research from a fresh, new perspective that no one has yet considered. The path to research can be tricky and is by no means straightforward. For many, part of this journey will include embarking on a PhD, perhaps the most challenging qualification to obtain. With such an established field, discovering a novel and substantial contribution that is worthy of a PhD is difficult, but absolutely achievable with sheer determination.

Disseminating PhD research at a conference – awesome! This is a real highlight of my PhD which brings great excitement for myself and I am sure, for many other young CI researchers too. Listening to keynotes and fascinating talks by superstars in the fields, networking within an enthusiastic CI community, and discussing new ideas are just some of the activities to look forward to. As a young researcher, one of the first hurdles is to establish a publications track record. This is the bread and butter for all researchers and there is a particular eagerness for young CI researchers to gain recognition for their research. Although publishing has not been easy, it has been riddled with potential issues. Let me tell you about the type of questions I have asked myself and others at times throughout my PhD. Is the authorship correct considering the contribution of authors? Why is the quality of reviewers' feedback so varied for my paper? LaTeX or Word format for the submission? There is no competition here, LaTeX wins every time, and so I extend my thanks to Donald Knuth and Leslie Lamport. But I do not despair in these sensational situations, seeking guidance and support from supervisors, mentors and peers to draw upon their expertise and wisdom, which really helps to shape the way I do and manage research. This is so important for young researchers and it should be taken seriously by all.

Much support is required for younger members to harness their abilities, and this is provided by academic and industrial institutions. Of equal importance is the role of our CIS in supporting younger members too. Student branches are a great opportunity to bridge the gap between the IEEE and younger members within academic institutions. Being involved with a student branch helps to develop individuals, universities and the CIS through seminars, site visits, networking, advice on professional development, and so on, the benefits are vast. Through experiences encountered as a younger individual, I have discovered that getting involved is very important, not just in research but in many aspects of life. Seeing how others get involved can be incredibly inspiring. Undoubtedly, some of the best examples that have had a lasting impact on myself are the interviews of CIS members published in the CI magazine. For example, the interviews of Kenneth De Jong [3] and Jim Bezdek [4] leave me feeling highly motivated and they encourage me to continually chip away at my PhD! I reiterate Jim's plea to read Peter A. Lawrence's article [5] on measuring our research outputs, it is an interesting read for all researchers. These serve as great examples of getting involved, they

contribute to bridging the gap with young members and are an incredibly inspiring rapport of people at the top of their game. Something I especially like is to hear talks from researchers that do not just discuss research methods and findings, but also talk about personal interests, life-long ambitions driving their research, general tips and advice, all of which can have a positive impact on the work of young CI researchers.

Looking back and trying to imagine conducting research before the internet was around does not bear much consideration! In the last 10 years, there have been massive changes in the way we access resources for research, such as literature, software, hardware and datasets. Without wishing to sound lazy, I have real admiration for the *old* process of physically searching for mouldy, old hard copies of papers in a dark, dank, cobweb filled library basement. Yet we are now on the cusp of another shift in research tools with the advent of e-readers allowing us to read papers electronically but as if they are in paper format. And soon the way we interface with home and work computers, such as eye tracking systems, will change once technology is realised. Just imagine students receiving an e-reader fully loaded with all the course books or even the latest IEEE CI magazine!

From discussions with academics and fellow students over many cups of tea, I see a challenge in securing a permanent academic position after university. Following the Spending Review [6] which has signalled cuts to higher education funding, there is enormous concern for young CI researchers as it is likely to be extremely difficult or nearly impossible, in the UK. The recent financial fiasco is an embarrassing pandemic, digging its claws into regions as far as the USA, Europe, Africa and Asia too, so there is little escape. Seeking advice is crucial in knowing how best to approach such high hurdles in the future where there will be fierce competition for the few available positions. This is the area where the CIS can greatly assist by supporting important initiatives that really help and encourage the younger members to successfully come out the other side. A promising opportunity is for industrial partners to be involved in future projects to maximise impact and set our economies motoring on the road to recovery, whilst simultaneously demonstrating the strengths of CI. After all, the goal of CI is to mimic intelligence which can be accomplished through real-world applications. This could well bring about longer term post-doc jobs that could help prevent young researchers bouncing from one short term job to another. Applying for funding is an alternative, but it can be difficult for young CI researchers with an underdeveloped track record, so it can be a tremendous challenge to start climbing the ladder. Achieving the expected high level of quality and knowing how to push the right buttons is difficult when creating research proposals that, in the words of IEEE, *foster technological innovation and excellence for the benefit of humanity*. But the tenacious quality of many young CI researchers will hopefully aid the transition of young to established, wherever that may be.

My personal experience of doing a PhD has involved hours of hard work supported by some very good times. I am learning to juggle many activities with as many limbs as my balance allows! Some of the most valuable support I have encountered has been from fellow students at various stages of their research in our research group, and at training courses and conferences too. Getting involved is hugely beneficial to feeling part of a group and helping to overcome the unfortunate aspect of isolation that is often associated with research. Fortunately we have a strong research group who enjoy socialising with regular meets for beer and breakfast, but not at the same time of course!

Despite hard times ahead in research, for what is already a very challenging field, I am extremely excited about the unknown future and what these untold adventures will entail. Current CI research for the younger members is actually more awe inspiring than stories of fictional Artificial Intelligence such as Skynet and ASIMO. This relentless interest and curiosity is ultimately what drives myself through the tricky research route. But the real crux of being a young CI researcher boils down to remembering that life is just one big game with numerous hurdles and high jumps precariously scattered along the track, and we are quite simply learning how to conduct research and to play the right move.

References
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