Reflections from:
Research Methods and Professional Practice

University of Essex, Master of Science, Cybersecurity

Introduction

This module is the final structured course prior to advancing to the Capstone Project and Dissertation. As such it called upon me to build on the foundational skills learned throughout the earlier modules and acquire the requisite knowledge of formal research methodologies, ethical principles, experimental design, literature review, peer review process and mitigating researcher / participant bias.

The expanse of reading and exercises for this module were a little overwhelming at first but comfortingly valuable as pieces congealed into experience and confidence. This reflective summary is constrained to this module and limited by word count to personal highlights and advancements of note. Yet, hopefully within this limited context the reader, and perhaps myself from time-to-time may read between the lines and envision the overall body of knowledge and depth of experience afforded by this MSc Cybersecurity Program. While the core academic subjects have been excellent, the personal growth is not limited to that sphere, but includes cohort peer reviews, summative feedback, and perhaps the greatest gift: an expanded exposure to a diverse, global point of view not heretofore offered within the confines of my lengthy professional practice.

A module syllabus and bulleted summary of the full Body of Knowledge from this module is presented in a support document, Summarizing the Full Body of Knowledge.pdf and linked in the main module page.

Notable Learning Reflections

The entirety of the MSc Cybersecurity Program was notable in that it differed so greatly from undergraduate learning and even occupational experience to some extent. I will expand on that briefly along with specific key takeaways that I believe will have the greatest impact on my future. Some may change the way I conduct my professional practice while others may be impactful because they established a new point of view or approach to correlating data. The overarching sum of the program is that the expanded knowledge, skills, tools, and world view has stirred within me the passion for life-long-learning. And while that has always been present, the return to formal academic study has invigorated that aspect of it and encouraged me that age is no barrier to continuing in that path. As retirement from my chosen field approaches, I may find my new passion in adjunct instruction. The following reflection points are chosen not because of the volume of knowledge gained but because they stand out as those most likely to have a lasting influence.

Ethics Applied Specifically to Machine Computing

For the last seven years, I have been leading research projects for emerging technology in transportation such as Connected Vehicle, Electric Cars, and reducing traffic deaths. Those settings relied heavily on the ethical standards set by U.S. and international policies and laws regarding research involving human participants.

The unit 1 examination of the ACM code of ethics and the associated exercises and case studies provided a formal backdrop on which to expand my knowledge of professional ethics and apply the principles which I already understood to computers, systems and technology advances.

One statement in the case study I reviewed gave me pause. The case reviewers (ACM Ethics Case Study, 2018) concluded that even though the whistle blowers were ethically bound to make the disclosure despite the NDA, they must be willing to accept responsibility for those actions and any accompanying repercussions. Initially, these two principles seemed mutually exclusive. To reconcile that both tenets were valid, I had to differentiate the legal protections against employer retaliation from the social repercussions from peers. This was a watershed moment for me

as I had always viewed ethics and morals as black and white. The impact of this exercise will affect my career and personal life.

Use of ML in Criminal Profiling

Another standout experience presented while conducting a literature review of the unreliability of ML applied to predictive analysis of future criminal activity. My examination of the sparse research data on this subject again lead to expanding my world view. Until this in-depth review, I had readily accepted the points raised in new articles and opinion pieces. For example, one defense raised by those who support ML for this use is that the rate of error is equally represented across racial demographics. I discovered that while the error rate was equal at roughly 20%, the impacts of the errors differed greatly as the false positive vs. false negative ratios were significantly opposite for whites vs. blacks. (Angwin, at al, 2016)

Exploring this enhanced my ability to apply critical thinking to the entirety of the research. I discovered weaknesses in the perspective and conclusions of the researchers in that while they discovered the qualitative errors in the system they were researching, they also introduced bias by ignoring the obvious racial and ethnic characteristics of some participants they classified as white in the data review. This enhanced criticality skill will serve me well in my career as I am involved in ongoing research and regularly review research papers for publication suitability. It will also have a positive effect on my own research conclusions and improve emotional intelligence.

Application of Deductive vs. Inductive Reasoning; and Experimental Design and Testing

In studying this topic, I discovered that much of my professional research to-date has primarily been based on deductive reasoning and pre-treatment vs. post-treatment testing. Critical review revealed potential pitfalls of this limiting approach. The chief revelation was that while deductive reasoning will lead to absolute truths so long as the underlying premises are also true, excluding inductive reasoning limits the potential for new theses to emerge and lead to breakthrough discoveries (Miessler, 2020) My future work and personal growth will be both be enhanced by this knowledge.

I also rely heavily on pre/post-treatment testing for validation. I now know a better outcome for validity is possible using experimental design with a pre-determined hypothesis test to measure validity.

Research Planning and Proposal Writing

My research experience has been limited to managing projects conceived by others. Armed with the skills garnered in this module, I am confident in designing and presenting my own research proposals.

References

Case: Automated Active Response Weaponry - ACM Ethics, Available from: https://ethics.acm.org/code-of-ethics/using-the-code/case-automated-active-response-weaponry/ [Accessed February 2022]

Also see e-Portfolio artifact: Unit 1 - personal reflection on review of an ethics case study

Julia Angwin, Jeff Larson, Surya Mattu and Lauren Kirchner, in ProPublica. May 23, 2016. Available from https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing [Accessed February 2022]

See artifact: Unit 7 – Literature Review – Implementing ML in Criminal Profiling – Reviewed within the context of the ACM code of ethics

Miessler, D, The Difference Between Deductive and Inductive Reasoning. September 23, 2020. Available from: https://danielmiessler.com/blog/the-difference-between-deductive-and-inductive-reasoning/. [Accessed March 2022]