

## Research Ideas - 2017

I am adding seven (new) entries to a research idea brainstorming list each week, over the course of 2017. Each block of research ideas are organized according to a month-week structure. Where a week overlaps between months, if the week is the fourth in the ending month the list update belongs to that month. Otherwise, the overlap serves as the first week in the beginning month.

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Thus, I encourage you to use these ideas as springboards for your own research. Quote, mix & match, revise...do whatever you feel inspired to do with the entries. I do ask that if a list entry is *italicized*, please do not use that exact entry in your work. An italicized entry means that I am using the idea.

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### January

#### Week 1

To what extent do cybersecurity course objectives in higher education correlate with cybersecurity job openings?

How strongly does visible trends in cybersecurity topics correlate with publishing trends? As well, what degree of academic literature is read?

Why is the negative minority of players more vocal than the positive majority?

What are the most common categories in cyber security jeopardy competitions? Are there common questions?

Do seminal studies in cyber security lab literature experience significant replication? To what extent are quantitative results validated?

Does completing homework produce a statistically significant increase in academic performance?

Why do we need to define a rule against violence/harm for AI (e.g. Asimov's 3rd Law).

## **Week 2**

To what extent do subjects with no less than five years experience programming display a different linguistic reality than subjects who have never programmed?

Does social media produce an operant panopticism and sense of action being over-scrutinized (and, thus, narcissism)?

What does it mean to ‘learn’?

What tools exist to objectively measure learning?

To what degree does number of lines of code in an open source project correlate with the number of contributors?

What is the half life of open source contributors (i.e., how long does it take for a contributor to fall off in the number of contributions)?

Why is feature parity the basis of comparison between FOSS software and proprietary software with ‘freedom’ not being included?

## **Week 3**

What are the characteristics of a ‘good’ question?

To what extent do multiple academic performance measures converge on the same outcome given identical input?

Why is academic procrastination seemingly a part of “student friendly” undergraduate teaching?

Will artificial general intelligence evolve biomimetic behavior?

Does a rising trend in user accounts give rise to malicious activity?

Can we use response rates as input to genetic computation of ‘better’ SPAM?

What is the relationship between account creation and receiving account targeted SPAM or phishing email?

## **Week 4**

Does knowing how the (human) brain works physiologically tell us how consciousness works?

Is the difference between a conscious mind and an unconscious mind the amount of (hidden) layers substrating propagation of neural impulses?

Will machine consciousness have the same idea of individuality as primate consciousness?

Is the probability of corruption in an arbitrary sequence of input computationally knowable?

Is there a significant difference between the efficacy of self-study compared to guided study?

Is there a significant difference between the efficacy of synchronous distance learning that includes audio-video of instructor compared to audio only?

What are the necessary components of a conceptual framework for post-transhumanist trust?

## February

### Week 1

Is the risk of executing untrusted code obviated by robust egress network filtering?

What percentage of publicly accessible source code requires a legacy compiler (version) to build?

What differentiates popular open source projects from lesser know but equally 'usable' projects?

At what rate do users search for open source alternatives to commercial software?

Are programming language syntax, semantics, and idioms stored and retrieved from declarative memory or motor memory?

How does variable programming study compare to focused study in learning a first programming language?

To what extent will machine consciousness experience cultural evolution of language?

### Week 2

*Will machine consciousness adhere to the logic, grammar, and rhetoric principles (i.e., the Trivium) found in human consciousness?*

To what extent are the 'logic' and 'grammar' principles of the Trivium present in computational model of the mind?

To what extent is the Trivium an effective model for the expression of internal computational problem solving?

What are the common perceptions of authentication as an assertion of biological identity?

Can a neural network be trained to differentiate between malicious access to a file system object compared to normal access to the same file system object?

How does the CPU usage profile of a virus that infects a particular file system object?

Does a keylogger produce a measurable ghost pattern as a user types?

### **Week 3**

Can programmer skill be measured according to what extent solutions to a given type of problem (e.g., search, sort, etc.) are expressed with a richer semantic basis?

What are the pedagogical qualities that comprise a ‘hard’ (rigorous) undergraduate course?

How does cybersecurity research incorporate ‘human factors’ (as defined by Stramler 1973) into empirical investigation of user behavior?

*What elements should be included in a conceptual framework for assuring confidentiality in synthetic cellular communication signaling?*

How effective is completing a ‘hard’ programming challenge in entirety compared to punctuated experience across multiple ‘Easy’ programming challenges?

*To what degree does Meyers-Briggs personality type correlate with doctoral student performance in designing research?*

What is the optimal frequency of laboratory exercise intervention on the learning experience compared to pre-defined KSA units?

### **Week 4**

*What epistemic propositions will artificial general intelligence develop in the context of technologically mediated Trust?*

*In what way(s) will artificial general intelligence generate social epistemic propositions for mediated Trust boundaries with non-AGI entities?*

*To what degree will a synthetic intelligence be able to articulate an epistemological rationale for trusting its knowledge?*

*To what degree will a synthetic intelligence be able to engage in mediated social epistemology?*

*How will a synthetic intelligence describe its own epistemology (e.g. Externalism vs. Internalism)?*

*What mechanisms will a synthetic intelligence develop to assure integrity of environmental stimuli?*

*To what extent will synthetic intelligence develop personality archetype(s) outside of the existing spectrum?*

## **March**

### **Week 1**

What are time management (productivity) best practices for minimizing distraction and maximizing output?

How does multitasking influence time management (productivity) throughput and cognitive load?

What is the relationship between multitasking and cognitive fatigue?

Is there an optimal task (or type of task) to schedule during pomodoro interval breaks?

What factors have a validated, positive effect on productivity throughput?

To what extent does technology have an effect on multitasking throughput and cognitive load?

What validated determinants exist for the objective measurement of task throughput and cognitive load?

### **Week 2**

Does time of day wake up preference affect task productivity?

Is there a specific genetic polymorphism or polymorphisms associated with shortened sleep cycles yielding restorative effects?

To what extent do polyphasic sleep cycles have a positive effect on task productivity compared to monophasic sleep?

What is the optimal time of day wake period for creative task productivity?

Does a validated protocol exist for measuring the minimal amount of sleep necessary to maintain maximum task performance?

How does polyphasic sleep cycling compare to transcranial direct-current stimulation for increasing task performance?

What are the early warning cognitive expressions of sleep debt?

### **Week 3**

Are there any biological signaling mechanisms that have evolved to prevent eavesdropping?

What are common characteristics of biological organism authentication?

How do single-cell organisms identify environmental threats?

What simple rules do individual bacterium follow when avoiding (evading) threats such as bacteriophages?

How do simple multicellular organisms detect duplicated chemical signals?

What is the maximum information threshold present in single cell organism chemical communication pathways?

What are the performance differences between digital communication pathways (e.g. copper, fiber optic, etc.) and biological signal transduction?

#### **Week 4**

What are the characteristics of a competent research mentor?

To what extent are the desirable traits of research mentors present in subjects across departmental boundaries?

What are validated quantitative measures of research design competency?

To what degree do various quantitative measures of research competency converge to identical values?

To what extent is there a measurable difference between single competency examination compared to multi-phased examination?

How can professor and student competencies be combined to maximize learning?

What are residency curricular best practices in evaluating faculty research competencies?

### **April**

#### **Week 1**

What is an effective assessment schedule for semester length undergraduate computer science courses to maximize learning?

To what extent are more frequent but smaller in scope examinations effective at maximizing learning compared less frequent but larger in scope examinations?

How do undergraduate students perceive flexible ‘contract grading’ curricula compared to traditional curricular scheduling of weekly homework, midterm examination, and final examination?

#### **Week 2**

#### **Week 3**

## **Week 4**

*To what degree do cognitive tasks associated with common cybersecurity tool use (e.g. Nmap) produce unique EEG patterns?*

*Can a non-invasive brain-computer interface be used to operate common cybersecurity tools (e.g. Nmap)?*

## **May**

### **Week 1**

What is the psychological effect of calling an activity a ‘game’ compared to a ‘competition’?

To what degree does citation count correlate with quality of published research within the citation list?

What is a sufficiently large citation count to be perceived as being a source of learning?

### **Week 2**

How can bidirectional knowledge trust be measured in an artificial intelligence tutoring system?

Why has pedagogical theory evolved over time to be less objectivist and more constructionist?

To what extent does academic assessment have a positive effect on in-class student performance?

How will an artificial intelligence tutor express an epistemology for *knowing* a concept versus an operation?

### **Week 3**

How do game engine mechanisms co-evolve alongside gaming community preferences for game features?

How effective are game AI agents in teaching players game rules while serving as an opponent?

What characteristics of a game AI agent contribute to player perception of difficulty?

What game AI agent attributes contribute to the player perception of life-like behavior?

How do players experience knowledge trust when interacting with autonomous game AI agents?

To what extent can an established game AI agent be used to train a new AI agent? Are behaviors identically reproduced?

How are game AI agents able to express internal knowledge of learned behaviors?

#### Week 4

What are the most common features associated with word processor files intended to be future-proof readable?

What is the mean lifetime for word processor applications between file format change?

How does a word processing system preserve semantic meaning across file format evolutions?

To what extent are (plain) text files more resistant to data degradation than word processor generated files?

What is a validated measure of *mean* time of data degradation in text files? Does the mean time vary by storage media?

What is the relationship between word processor software decay and data degradation of the files generated by the software?

To what extent do frequently accessed text files incur data degradation compared to infrequently access text files?

## June

### Week 1

What is an optimal pedagogical framework for teaching undergraduate mathematics in a synchronous online computer science program?

How are students most effectively incentivized to complete homework assignments in a synchronous online undergraduate mathematics course?

Do students perceive online synchronous mathematics courses to be as effective as traditional on-campus courses?

What is an optimal number of homework assignments in an online synchronous mathematics course, including the number of questions per assignment?

To what degree is game-based learning an effective pedagogy for advanced mathematics instruction?

What features would a game engine need to be used as a situated learning platform for teaching advanced mathematics?



To what extent do students use syllabus defined learning outcomes to measure self-efficacy in learning during undergraduate coursework?