Big Data and Big Implications for Bio-cybersecurity



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Big Data and Big Implications for Bio-cybersecurity

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Neuroscience... *puts the brain at our fingertips*



Progress in Neuroscience

Heuristic Reciprocity



Advances in Neuroscience

Translationally viable

- Anatamo-physiological correlation
- Individual trajectories of expression
- Populational variation and pre-dispositional assessment



Integrative Scientific Convergence (ISC) in Neuroscience

Conjoins:

- Natural sciences
- Biotechnology
- Anthro/social science(s)

Focus upon assessment, access and manipulation of neural structure and cognitive, emotional and behavioral function(s):

-Individuals

-Groups

RELIANT UPON DATA INTEGRATION, SHARING AND USE... BIG DATA

Validity-Reliability-Utility Issues

- Need for large volume data banks
- Individual, cohort and population data tiers
- Intra- and inter-tier integration potential
- Longitudinal input requirement
- Rapid (real-time) access requirement
- Non-anonymity



NeuroCyber/Big Data Approaches

- Maximize storage and retrieval
- Parallel computing
- Scalable, customizable
- Accessible and sharable



Data Acquisition and Tracking

- Across domains
 - Cellular-to-social
- Across levels
 - Individual, cohorts, groups, populations
- Across geographic locales
 - Complete geo-spatial access
- Across time
 - Individual and historical timespans
- Across groups
 - Comparatively and normatively

1: Appropriate analyses 5: Understand detailed patient-level data in context	2: Platfo host stan and inteq tool 6: Person Medic	3: Preventa and persona health interventi	Relating the ndividual to e population	D	22: Collect health information from the point of care 26: Text/Data Analytics for Clinical Decision Support		23: Generating hypotheses from databases 27: Discovery of composite biomarkers 31: UX 35: events to		24: make hea service use d widely availa 28: Monitori compliance v best practic 32: Anonymisati	Ith 25: Combining ata Data ble Repositories ng 29: Variety rith se 33: Enhancing predictive healthcare on 27.		59: structured info common to health and social care 60: Learning from data		
7: Learning healthcare system 8: Rapid feedback learning health system 9: Better evidence-based decision-making 10: Closing the		13: Re c media 15: F Int 17: Ir data 19: : Media on Ima	eporting on urrent cation use Predictive lerence ntegrating sources Stratified cine based Clinical age Data	14: Ex sequence/ mining language 16: Pred model Learn Health Syste 18: Devel of Diseas Predic	vent Iprocess g via models dictive lis in ning care ems opment es Risk ction		30: Data Scier for Mental Health 34: Use of G patients recor to improve healthcare	iP rds	data to information & knowledge		and Recor Linkage 36: GDS- inspired, Digital-by- Default IT Transformati	 Opportunistic detection of disease from images . 		61: Strategic analysis of
gap between evidence and action 11: Automated interventions 12: Personalised Healthcare	BLUE	21: System data A		Algorit 20: D integration ing	Igorithms 20: Data pration/wrang- ing		38: Geospati data mashups heterogeneo sources	al of us	39: Weather & Pollution Data/Forecasts in Health Care		40: Use of genetic information	ORAN 41: Critical realism PURP	GE	research projects 62: robust holistic assessment of healthcare system
42: Smartphone apps to improve outcome assessment 49: Exercise and glycemic control in type 1 diabetes 52: Patient safety	martphone 43: Deep ti to improve imaging utcome esesment 50: Theory overfitting surviva mic control analysis iabetes t: Patient 53: Patis safety safety		issue 44: Analysis of us On-line Behaviour yg in 51: Combating al Healthcare is Associated Infections (HCAIs) tient 54: ty Understanding		Monitoring n improve agement of relapse : Drug Adverse ents Detection	46: mo CO	Continuous nitoring of PD patients	47: dis pera c co	: Second 48: A seases in rel reons with neur chronic con onditions		ssist gait hab of ological ditions	56: Bristol Population Laboratory (BPL) 57: Supporting managed self- care in chronic conditions 58: Biomedical data integration	ER	-
improvement			patient journey's through the NHS		using Data Mining						PINK		SILV	

Individual Data



Group-analytic Data





The "Black Box" approach



Caveats

- If it's assessable, it's accessible
- If it's tagged, it's targetable
- If it's stackable, it's hackable
- What's hackable is manipulable
- What's controllable is corruptible



Engaging NeuroCyberS/T as a "Weapon"...

A.) n. (Old English) 1) "a means of contending against another " and 2) "...something used to injure, defeat, or destroy"

and

B.) An agent that...

1) mitigates aggression and fosters thoughts and feelings of affiliation or passivity, 2) incurs burdens of morbidity, disability or suffering and in this way "neutralizes" potential opponents, or 3) induces mortality

Weaponized NeuroCyberS/T

Tactical and Strategic Impact(s)

Effects

- Proximate (Tactical)
 - Accessibility and use/misuse of data
 - Development of "precision pathologies"
- Intermediate (Tactical-Strategic)
 - Data modification
 - Public life effect(s)
- Distal (Strategic)
 - Economic impacts
 - Social impacts
 - Net impact on "New Global" milieu



NeuroCyberS/T to Affect Opposing Elements

- Weapon of Mass Destruction possible...
 - RDTE/Use in ways (e.g.- "precision pathologies")that "side-step" current BTWC, CWC
- <u>Weapon of Mass DISRUPTION</u>...
 - RDTE not necessarily bounded by BTWC/CWC
 - Highly effective; both non-kinetic and kinetic
 - Can be covert/non-attributable in use
 - Incurs "ripple effects" on/across scales and levels

<u>See:</u> Giordano J, *Nat Def*, 2017; Giordano J, 'Neurotechnology, global relations and national security: Shifting contexts and neuroethical demands'; and: Wurzman R, Giordano, J. 'NEURINT and neuroweapons'; In: Giordano J (ed.) *Neurotechnology in National Security and Defense*, CRC Press (2015).

NeuroCyberS/T on World Stage

- Global NeuroS/T Economic Predictions 2020
 - China (on pace to out spend U.S. by an order of magnitude over the next 10 years)
 - Predicted 60-68% increase in RDTE by 2025
 - Predicted 50-53% market share by 2025
 - Russia
 - Iran
 - North Korea
 - Virtual nations
 - Non-state actors



Lack of focus and commitment on our part provides exponential growth opportunities for others

Core Questions and Issues

- What do we do with the information and capability we have?
- What do we do *about* the information and capability we don't?
- Given what *can* be done, how do we (and who will) decide upon what *should* be done?
- Will be able to do what we decide we should?

"Preparedness Process"

- Identify risk scenarios that evolve from specified events
- Craft strategies for preemption, preparation, response, and amelioration
- Examine (setting, exploring, and exploiting) conditions at the operational level, across all elements, and the physical, cognitive and informational domains
- Create strategies that are relevant, durable, and can be targeted for demographics and psychographics in the face of severe cultural impact
- Identify/plan a robust framework to remain effective and adaptive to a changing environment as risks and society (co-)evolve.

Key Steps

Core premise: Need for NeuroCyber Tools & Methods

- Need for NINA now (see Kostiuk, 2012)
- Need for programmatic neurobiocyber-security
- Need for ongoing surveillance (of field and RDTEU loci/foci)
- Need for discourse/dialog
- Need for communication

Four Thrust Strategy



Necessity of a Whole of Nation approach to identify, characterize, counter, and exploit/prevent emerging technologies that threaten or erode United States' security and stability



Summary

- Current NeuroCyberS/T growing exponentially: clear and present danger to U.S. national security and stability
- Identified risk/threat should prompt:
 - Funded research in technologies, innovations, countermeasures, and solutions
 - Capabilities to address and defeat evolving kinetic and non-kinetic threats
 - Remaining ahead of competitors'/adversaries' abilities to exploit U.S.
 - Whole of Nation approach for leveraging all sectors of national power

"Victorious warriors win first then go to war, while defeated warriors go to war first then seek to win."

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