American Policy for Human-AI Collaboration:

In Which Our Heroes Discover We’re All Fucked

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**Executive Summary**

Paper summarized. Executively.

**Problem Description**

The development of Artificial General Intelligence (AGI) may well be the single most disruptive event in human history. In 2015, Stephen Hawking described human-level artificial intelligence (AI) as “likely to be either the best or worst thing to ever happen to humanity.” (Tegmark, 2015). He speculates that a truly superhuman intelligence is both unpredictable and uncontrollable by merely human minds. If such an intellect has goals incongruous with those of biological entities, humanity runs the risk assumed by ants in the face of human urbanization. Even in the absence of malice, the ants may be swept away unnoticed, simply as a side of effect of progress. Other flavors of AI apocalypse are less dramatic but pose an existential threat to humanity as we know it. Perhaps humans become explicitly subordinate to AGI, perhaps the AGI usurps the human agency we associate with free will. Seán Ó hÉigeartaigh, the Executive Director of the Centre for the Study of Existential Risk at the University of Cambridge pointed out that the risks inherent to such a transformative technology only become more difficult to mitigate the longer we postpone addressing them (Ó hÉigeartaigh, 2015). In June of 2019, the Select Committee on Artificial Intelligence (SCAI) of the National Science and Technology Council (NIST) released the latest version of the United States’ National Artificial Intelligence Research and Development Plan. This plan focuses on seven strategies for Artificial Intelligence (AI) research and development. Given the potential impact on the future of human development, the second strategy, Developing Effective Methods for Human-AI Collaboration assumes particular import. Unfortunately, as it stands, this strategy is woefully underdeveloped.

**Policy Description**

NIST predicts three ways in which AI and humans are likely to interact. The first envisions human and AI entities working in partnership. This may entail the AI performing supplemental tasks to support the human, or providing additional capacity for the human agent to access at need. An AI my also act as a failsafe, intervening or providing augmentation when task complexity spikes, temporarily overwhelming human capability. Finally, an AI may operate autonomously in place of human agents in environments or on missions which exceed human limitations, or to which humans are poorly suited.

The current policy revolves around four tenets: seek new algorithms for human-aware AI, develop AI techniques for human augmentation, develop techniques for visualization and human-AI interfaces, and develop more effective language processing systems (NIST, 2019).

Explain each tenet. Boring, but necessary.

Algorithms –

Augmentation –

Visualization –

NLP -

**Problem Identification**

In its current incarnation, the NIST policy more closely resembles wishful thinking than a plan constructed to bring about a desired outcome. It is both short-sighted and narrow in focus, reading as though it was purchased by industry members if not directly dictated by the same. The policy repeatedly cites industry and academia as leaders in AI development, and seems content to maintain this status quo (NIST). As the subprime mortgage crisis demonstrates, the profit motive that drives a capitalist economy can easily override market actors’ better judgment, leading them to choose short-term gains over long-term health. The sheer power offered by successful AI implementation creates an even more precarious scenario. Not only is the temptation orders of magnitude greater than that of mere lucre, but tragedy no longer requires an entire industry to abandon its social conscience. Instead, a single slipshod AI implementation has the potential to irrevocably alter the course of human development. Further, given the unparalleled advantage of being the first to field a fully-armed and operational AI agent, market competition is likely to devolve into a race to the minimum acceptable outcome as competitors cut corners to expedite delivery. This dramatically increases the chances of an unacceptably flawed AI going live.

While the NIST plan does propose the implementation of standards and benchmarks for AI development, as outlined in the policy these are largely focused on improving capabilities of and expediting the delivery of AI systems. Notably missing is any explicit requirement for the development of ethical AI. Also absent are any requirements for the goals of and restrictions on AI systems. Instead the emphasis is on “fostering” the development of AI in the commercial realm in keeping with President Trump’s directives to “to enable the creation of new AI-related industries and the adoption of AI by today's industries” and “reduce barriers to the use of AI technologies” (Trump, 2019). According to futurist Max Tegmark, control is correlated with intelligence (Tegmark, 2018). The creation of true AGI , or even a sufficiently advanced narrow AI along the correct axis will then likely be uncontrollable by human agents. This necessitates the installation of human-aligned goals and restrictions in the infancy of any AI system. Patching core modifications into any mature software system is always a fraught business. Doing so in a system as complex as any AGI must be is a Sisyphean task. Even the creation of human-compatible goals and restrictions looks to be a Herculean labor, as it first necessitates understanding and codifying goals for humanity, a complex multidisciplinary effort likely to require years of effort. The humanitarian goals need to have absolute primacy over performance or effectiveness goals. Even a single failure in this regard can create a cascade resulting in an AI whose goals dramatically diverge from those of humankind. Given the complexity and importance of the task, defining the goals of and strictures on AI agents would seem to be at least as urgent as performance standards, yet is thoroughly ignored in the current policy.

While the distribution of AI development between competing corporations, agencies, and universities undoubtedly drives innovation, it also creates a regulatory and enforcement nightmare and incentivizes subversion of any restrictions in place. In addition to the safety concerns previously discussed, this fragmented marketplace creates philosophical issues. The marketplace of ideas works well for easily replicatable systems. These enforce a degree of equity as competitors can easily overtake the market leader simply by adopting the current best technology and iterating on it. With opaque systems such as strong AI, there is no such guarantee. The first entity to create an AGI may obtain an insurmountable advantage as, even with precise replication steps, duplicating the result my be impossible. This possibility escalates asymptotically towards certainty as AI beings to iterate on itself, diverging rapidly from its initial design. This paucity of competition creates an aggregation rather than democratization of power, allowing those who own the means of production to increase and solidify the social and economic chasm between themselves and their supplicants. Should the United States wish to maintain even the pretense of a democratic society, it must ensure egalitarian access to this transformational technology.

**Actor Identification**

As an AI researcher I (appropriate first person?), I am concerned by:

Measurable metrics – how do we track progress and compliance?

Conflict of profit motive with humanity

Agency issues

Executive authority –

Coordination of effort

Motivation of competition vs. the efficiency of cooperation

Nationalization of goals

Centralized command and control

**Potential Solutions**

Government Oversite – Regulation. Watchdog agency. Comfortable, familiar, ineffective:

SEC – banking crisis

FCC – network infrastructure

Government Contracting – Government as sole employer of AI systems. Industry as contractors

Military-Industrial complex

Hilarity of “Military-grade”

Nationalization – Ultimate centralized command and control

**Recommendation**

With good reason the United States government has historically claimed a monopoly on domestic research into transformational technology. The U.S. Army Corps of Engineers did not solicit bids on the Manhattan Project. Unlike traditional traditional technology development which permits iteration over a prototype to define a path of constant improvement, some technologies demand to be treated with more respect. Moving fast and breaking things is a laudable ideology for disrupting the status quo. It is somewhat less appropriate for thermonuclear weapons, AGI, self-replicating nano-tech or any other system with a reasonable chance of kickstarting an apocalyptic positive feedback loop.

Because control is correlated with intelligence, superhuman AGI inevitably decreases human agency. Should this power devolve to corporate hands or be held by actors at least nominally responsible to the public? Citizens have already tacitly agreed to some degree of tyranny on the behalf of the government in order to promote public good. The government does have some degree of public accountability. Corporations not only have no such accountability but have repeatedly denied that they have any responsibility along that axis. In the landmark case of *Dodge vs. Ford Motor Co.*, the Michigan State Supreme Court affirmed the corporation’s legal responsibility to reward its shareholders monetarily rather than provide a social benefit. The consequences of AI development are simply too severe to be left to the vicissitudes of the market.

**Evaluation**

Industry – these requirements will substantially slow down development, cutting into profits and potentially putting them behind the international competition

Rejoinder: AI is too important to be a race to the bottom as everyone tries to cut corners to be the first. In this case, it is better to be right than first. We may also need to develop AI countermeasures. We cannot necessarily interfere with AI development in other countries, but we can harden our own targets. While chasing AGI, build a parallel suite of narrow AI applications designed to keep us on par in selected critical areas?

Defense – Slower development puts us at a disadvantage in armed conflict.

Rejoinder: Rely on existing military supremacy while our AI catches up. If necessary throw them the sop of increased funding for conventional defensive measures. A well-constructed AI should be able to iterate more rapidly over itself. Additionally, a poorly-constructed AI will pass its flaws on to its children. It is much easier to build correct software (TDD?) than to debug broken software. This exponentiates as software designs software. Inherited defects rapidly become impossible to correct since nobody understands the system.

**Policy Breakdown**

**Five principles for AI**

1. Promote Sustained AI R&D investment
2. Unleash Federal AI resources
3. Remove barriers to AI innovation
4. Empower the American worker with AI-focused education and training opportunities
5. Promote an international environment that is supportive of American AI innovation and its responsible uses
6. (bonus) Leverage AI to help Federal government work smarter

Potential problems:

1. Nothing about ensuring responsible development
2. Nothing about ensuring responsible employment.
3. Descriptive vs. prescriptive: Lots of buzzwords, no plans

**Strategy 2: Human-AI collaboration**

“While completely autonomous AI systems will be important in some application domains (e.g., underwater or deep space exploration), many other application areas (e.g., disaster recovery and medical diagnostics) are most effectively addressed by a combination of humans and AI systems working together to achieve application goals”.

This vision is both short-sighted and narrow-minded.

Presumes no transformational changes in AI capability.

1. We already see AI performing medical diagnoses.
   1. Skin Cancer
   2. Eye conditions – Deep Mind at Moorfield’s Eye Hospital and University College London. 94%
   3. Image-based diagnosis – 14 studies combined in Lancet (Denniston, Liu, et al.)
      1. Better disease state detection
      2. Better all-clear accuracy

“Complementary nature of humans and AI systems”

What is the nature of an AI system? Since AGI does not yet exist, how do we characterize it?

Better to *define* the nature of the AI systems we want to build

Enforcement? Hahah.

**AI-Human divisions:**

1. AI performs functions alongside the human – Partnership
   1. Why is the human necessary here? Safety? Comfort?
   2. Or is this just a transitional state as AI grows?
2. AI performs functions when the human encounters high cognitive overload – Supplemental
   1. Which system has precedence in a conflict?
3. AI performs functions in lieu of a human – Replacement
   1. Phrased as handling tasks for which human capacity is limited
   2. Isn’t that ultimately every task as AI capability scales more rapidly than humanity?

Human-centered automation principles:

1. Employ intuitive, user-friendly design of human-AI system interfaces, controls, and displays.
2. Keep the operator informed of critical information, AI system state, changes to state
3. Keep the operator trained.
   1. Recurrent training for general knowledge, skills, abilities (KSA).
   2. Training in algorithms and logic employed by AI system
   3. Expected failure modes of the system
4. Make automation flexible. Operators decide whether to use the AI system.
   1. Adaptive AI systems to support human workers during excessive workload or fatigue
      1. This is essentially replacement with some gift wrap. There is no way this technology is not used to replace the worker.

**Algorithms for human-aware AI.**

Interact intuitively with users.

1. Shallow interactions – User discards option recommended by the system
2. Model-based approaches – use the prior actions of the user
3. Deep models of user intent – based on accurate human cognitive models
   1. Yes, the plan is for the machine to know what you’re thinking. This definitely won’t be abused by every government agency ever.

Interruption models – know when to interrupt the human. This implies super-human understanding of the task. How does this not become replacement?

Develop emotional intelligence – Good goal. Good luck.

Generalization – system of systems

Many AIs interacting with many humans

**Human Augmentation**- Transition from narrow devices to multifunction devices

1. Types
   1. Stationary
   2. Wearable
   3. Implantable
   4. Environmental – this seems redundant with stationary
2. They’re basically chasing Scalzi’s BrainPal
   1. Privacy concerns.
   2. What about explicit and implicit control
      1. Information flow
      2. Physical control
3. Active learning – relies on human SMEs when the AI is uncertain during training
   1. Who chooses the SMEs? This definitely won’t devolve into a huge Charlie Foxtrot.

**Visualization and human-AI interfaces**

1. Who is responsible for designing these? Many current interfaces are designed by programmers and it shows. Which disciplines should be responsible for the interface design, and who should have precedence when back-end and front-end functionalities collide?
   1. If we are to have truly human-friendly AI the interface should drive functionality, not vice versa. This will be a difficult prospect to sell.

**Language processing systems**

1. Currently capable of understanding fluent English in quiet surroundings
   1. How to handle biases inherent to languages? Xenophobia?
   2. What about the multilanguage question? Should English be the official national language for AI interaction? How does this affect the spread of AI? Reinforce classism?
2. Working towards establishing emotional and environmental context for speech
   1. Yeah, that’s probably a good idea.

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