Fiona Seoh

David Evans

Pavilion Seminar: A.I. on Human Behavior

14 December 2018

Enhancing Life by Quantifying Death

While we use it to gage where we are in our life span, we know that our chronological age is not the most effective measure for our life span by far. Artificial Intelligence, specifically deep neural networks, are being applied to big data on blood samples in order to more accurately measure our biological age and pinpoint how we can lengthen it. Matching our personal blood tests with A.I.-driven analysis of blood tests on 13,000 people spanning South Korea, Canada and Eastern European populations can compare our cell deterioration rate with people our age to determine whether we will live longer or die younger than other people our age and how to increase our odds to do former. Given A.I.'s advanced predictive ability, it is also transforming end of life care by being better able to fulfill patient's wish to die at home rather than in the midst of aggressive futile care. Many startups offering rings, watches, and bracelets, claim to offer even more precise real-time monitoring of health, claiming users with more knowledge are more likely to proactively take charge of their health. It is unclear how much tracking data benefits or influences youth behavior and the products pose liabilities to personal health data security. Despite A.I. not visibly altering our day to day behavior drastically, A.I.'s predictive abilities are reshaping our conception of our time left on earth and how we spend our final days.

Despite the average life expectancy for U.S. men being 76 and women 81, chronological age has long since been known not to be the best metric for lifespan with the actual biological age being as far off as 30 years (Jefferson). While many attempts to pinpoint biological age

markers have failed, A.I.'s deep learning ability equips us with better detection of patterns in big data than ever before. At Insilico Medicine, this technology is being paired with the largest pool of blood work ever used in a longevity study on 13,000 people (Jefferson 2). The blood test analyzes 21 parameters, including cholesterol, inflammation markers, hemoglobin count, albumin levels, and 17 other chemical variants in order to predict the rate of cell deterioration and compare it with the average of those our age (Jefferson 2). Deep Neural Networks are trained on healthy individuals in order to predict age and optimal health (Jefferson). The result is an algorithm website, named young.ai, that provides its visitors with real time information on their potential life span and offers precise personalized suggestions on how to lengthen it through preventative, proactive action in exercise, diet and supplements (Jefferson 3). Alex Zhavooronkov, PhD, CEO of Insilico Medicine, hopes that such a service can serve as a wakeup call for those whose bodies are aging at an unhealthy pace and provide more agency for individuals within such expensive healthcare systems. Not only does the algorithm aim to pinpoint predictors but it also measures efficacy of a drug in clinical trials in order to detect whether use of the drug shifts the patients from high to lower-risk status (Jefferson 3).

With 7.4 million people reaching age 65 or older and set to make up 20% of the U.S. population by 2029, such preventative care services offer an opportunity to cut massive costs in healthcare bills as well as keep an older generation able to produce and contribute to the economy, thereby alleviating the burden of care for the elderly (Jefferson). The closest competitive service uses General Adversarial Networks to simply predict a user's appearance in old age (with little proven accuracy). Despite its myriad of benefits, Insilico has drawn concern over privacy but Zhavooronkov claims the information extracted is low value, amounting to less gathered by one's Facebook profile (albeit a low bar). While the parameters are said to be

insufficient to identify users, the service still encourages users to use a nickname as opposed to their given name. Users can subscribe for free aging analysis on the site by uploading 18 parameters that appeared in their last blood test, including glucose and albumin levels as well as a facial photo in the hopes of enabling the algorithm to recognize signs of aging from photographs (Jefferson). The more users join, the more honed our knowledge on how to slow our biological clocks grows, lengthening not only the span but the quality of our lives.

A.I. in healthcare is not only reshaping how we live but also how we choose to die. 80% of Americans would rather spend their final days at home but only 20% actually do (Avati et al 1). Moreover, 60% of deaths occur while the patient is undergoing aggressive care in acute care hospitals during their final days, thereby creating a conflict between the patient's wishes and their actual treatment (Avati et al 1). This is due overwhelmingly to physician overestimation of a patient's prognosis, time left, and attainable cure. Despite their over-optimism, clinician judgement continues to be the leading method in predicting survival span of terminally ill patients (Avati et al 2). Patients need physician referral in order to gain access to palliative care, an alternative to treating the disease that focuses on providing relief from symptoms from a serious illness and improve quality of life. Deep Learning in Electronic Health Record data aims to address with a universal pre-screening patient program. All admitted patients are immediately evaluated by an algorithm that side-steps time-consuming face-to-face physician consultation and notifies the Palliative Care team directly of patients likely to benefit from their services.

While previous systems were limited to diagnosing specific terminal conditions, this algorithm provides an all-cause mortality prediction on all admitted patients, striving to predict patient mortality within the next 12 months (Avati et al 4). The Deep Neural Network is trained on Electronic Health Record data from previous years on the individual patient. While

traditional systems have Palliative Prognostic Tools that calculate need for palliative care (from fluid intake and state of consciousness), they are designed to be used in a palliative care setting instead of identifying them earlier, thereby forgoing a crucial opportunity to discuss with conscious patients on their desired alternative care path (Avati et al 3). On the other hand, prevalence of death among patients admitted to palliative care based on the algorithm recommendations is 11% (Avanti et al 4). While low, the model has potential to pinpoint factors as to why it assigns high probability of need for palliative care and whether the prescription of a given drug either heightens or lowers their probability of approaching death, thereby improving both diagnoses and treatment. As the algorithm strengthens with all admitted patients and their incoming results from care, the algorithm has potential to not only shed light on what factors expedite death for the terminally ill and how to mitigate them, but also give patients unprecedented agency over how they choose to spend their remaining life.

The limit to these A.I. healthcare predictive abilities appears to stop at healthcare wearables. A.I.-driven rings, bracelets and watches collect real-time data on their users (sleep patterns, heart rate, and steps) with the claim that enabling users to follow their own progress will increase their likelihood to adhere to treatment plans and change their behavior. For example, if a heart disease patient is prone to developing a rapid heartbeat after walking for a given amount of minutes, the medical device can alert the user when they are exceeding the recommended minutes of walking. Despite these bold claims, it is still unclear how much data tracking actually benefits users or influences user behavior. A recent survey even revealed that 32% of users stop wearing the device after 6 months, increasing to 50% of users within a year (Piwek 1). A majority of wearables appear to be a solution in search of a problem, not visibly impacting the health of users given that early adopters are already health conscious and are

simply seeking a means to quantify it. Nevertheless, while they show little promise among the health conscious, wearables appear beneficial to those suffering from depression and sleep apnea by identifying the severity of depressive symptoms from amount of physical activity and sleep patterns. The pedometer feature among the elderly especially has been associated with increased physical activity and decrease in body mass index and blood pressure (Piwek 1). That said, the lack of initial impact of wearables may in part be due to human tendency to favor reactive care rather than proactive maintenance.

In conclusion, the growth in ability to both gather and analyze massive amounts of healthcare data has flung wide the doors to detecting factors that expedite death and how to mitigate them or prepare accordingly. This has potential to not only maximize our life spans but improve their quality as well as give us more precise warning of imminent death. While the impact of real-time data-tracking wearables appears negligible among the healthy, much of their impact is dependent on human willingness to change behavior before warning signs become an actual problem. For those willing and interested in taking charge of their healthcare, our point of intervention and proposed treatment is growing ever earlier and more precise, enabling us to begin with the end in mind in how we live our lives.

Works Cited

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