Deep Longevity

DEEP LONGEVITY
Live Beyond Limits!

Company Profile

Deep Longevity is a longevity-focused AI company that will develop and provide the customised predictors of human biological age to the network of Human Longevity Inc (HLI) concierge longevity clinicians. Specialising in the development of deep biomarkers of aging using clinical blood tests, transcriptomic, proteomic, epigenetic, microbiome, behavioural, wearable, imaging and multiple other data types, Deep Longevity will provide a broad range of deep aging clocks to some of the world's most advanced longevity clinics and physicians and is developing a range of simple consumer applications to track the rate of aging at the individual level. Deep Longevity developed the Longevity as a Service (LaaS)© solution to integrate multiple deep biomarkers of aging to create the deep aging clocks that will provide a universal multifactorial measure of human biological age.

Deep Longevity is a spin-off company of Insilico Medicine, a Hong Kong drug development company created in 2014 by Dr Alex Zhavoronkov and a group of like-minded AI enthusiasts. Insilico Medicine moved on to develop a suite of products to serve the drug development process: PandaOmics for transcriptomic analysis and target discovery, Chemistry42 for molecular design, InClinico for clinical trial optimisation and other tools. A special division of Insilico Medicine was tasked with the research of aging and geroprotectors. They developed a consumer antiaging platform: Young.AI. The division's main research focus was the aging clock technology: a set of statistical approaches that allows for the quantification of the most basic aging processes. Aging clocks serve as a yardstick to measure the efficiency of geroprotectors, making antiaging drug design possible. In 2020, the biomarker division split into its own company, Deep Longevity.

“Biology of a living organism is a dynamic process with trillions of features changing in time at the atomic, molecular, cellular, tissue, organ, system, organismal and environmental levels. And the best way to study biology is to track all these features in time at the highest resolution possible to understand the causality and the intimate interplay of these features. In 2015 we were the first to realize that one of the most impactful applications of deep neural networks is the prediction of age using massive amounts of longitudinal time series data. Since then, we have developed a very large number of aging clocks using multiple data types, many of them published, patented and tested in a broad range of applications. This experience allows us to tap into a broad range of industries such as healthcare, clinical, consumer, life insurance and even psychology. Our mission is to extend healthy productive longevity and we are developing a new field of longevity medicine, in which the objective is not only to prevent disease, but also to keep the individual as close to the age of optimal performance during the entire life span as possible.” Alex Zhavoronkov, PhD, founder of Deep Longevity.

Deep Longevity has developed several aging clocks for all antiaging needs. It is the only company that measures the pace of aging using nine data dimensions. By bringing different data types together, Deep Longevity can tell much more about individual aging processes. All its aging clocks are developed using deep-learning approaches and its models take in the whole context of a person's aging trajectory, offer insights into how to slow it down and, most importantly, quantify the future effect of any recommendation. Deep Longevity established a research partnership with one of the most prominent longevity organisations, Human Longevity, Inc. to provide a range of aging clocks to the network of physicians and researchers.

The company is developing a comprehensive decision support system for physicians to enable the development of personalised longevity protocols using the latest advances in longevity biotech. The products it has developed for clinics include comprehensive PDF reports that allow physicians to monitor their patients' aging intensity, API access to Deep Longevity aging clocks and a soon-to-be-released service “Longevity Coach”, which will be a patient managing software and network platform for longevity-focused professionals. Providing these longevity services to clinics and hospitals aids them in providing tools to patients that will allow them to live longer and healthier.

Deep Longevity is also targeting the insurance sector by providing longevity services that will allow insurance companies to give more value to the customer and increase retention. Furthermore, global societal aging has generally been considered detrimental to a country’s economic health since it reduces the workforce and increases burdens on healthcare systems. A key part of longevity and increased healthspan is the freedom to work; when workers are living healthier, longer lives, an aging workforce can be an opportunity to boost the economic productivity of the employees.

Deep Longevity is also establishing a Longevity Network with Young.AI at its core. Young.AI is the first longevity cloud platform to connect all the stakeholders such as physicians, clinics, hospitals, insurance companies and wellness centres together, making it easier for end users to access longevity services. Young.AI helps people to discover the ways to preserve their health over long periods of time and to experience, achieve and finance superior longevity. Its PDF reports provide detailed information on current biological age and give personalised tangible recommendations.

Originally incubated by Insilico Medicine, Deep Longevity started its independent journey in 2020 after securing a round of funding from the most credible venture capitalists specializing in biotechnology, longevity and artificial intelligence.

Flagship Product Deep Dive

BloodAge

BloodAge is a neural network that estimates a person's pace of aging from their blood panels. So far, this is the most popular aging clock among Deep Longevity clinical partners. The model that eventually received the name of BloodAge was initially released in a 2016 publication by Putin et al. This publication showed that it was not necessary to employ high-end lab equipment, such as sequencing or genomic array platforms, to determine one's rate of aging. The blood panels that BloodAge uses are relatively inexpensive (<$200) and can be prepared in any clinic within days compared with >$350 per sample for epigenetic aging clock (dominant aging clock in the field of age prediction) and usually comes in tow with a prohibitively long turnaround time of over 30 days. BloodAge uses only 30 blood biomarkers, shown to be associated with mortality in different populations and can estimate the survival time of hospitalised COVID-19 patients.

BloodAge reports give a personalised longevity plan with just a simple blood test. Deep Longevity tests a minimal of 30 blood biochemistry and cell count markers to calculate the end user's biological age. People with a BloodAge that is 5 years higher than their chronological age have double the mortality rate, compared with "normal agers". Conversely, slow pace of aging, as reflected by a biological age 5 years younger than your chronological age, is a protective factor. Deep Longevity's deep aging clocks can provide information on how each individual marker contributes to the final age prediction in years and identifies the optimal path for lowering BloodAge. The BloodAge report then returns personalised longevity plans to help clients reach their optimal biological age.

Product efficacy

BloodAge's efficacy is verified by a peer-reviewed publication by Putin et al, "Deep Biomarkers of Human Aging: Application of Deep Neural Networks to Biomarker Development". In this publication, over 50K blood samples from one lab service provider in Moscow (In Vitro Labs) were used to train the neural network to estimate patients' age. The aging clock was validated in a cohort of over 6K patients and predicted age with a mean absolute error (MAE) of 5.6 years. The medical relevance of BloodAge has been shown in several follow-up publications. In a further 2018 study, BloodAge was tested in three populations: Canadians, Eastern Europeans and Koreans. In all these cohorts, high predicted age was recognised as a significant mortality risk factor. Other evidence of BloodAge's clinical relevance was presented in a 2019 study, in which smokers displayed higher predicted age compared with non-smokers.

Product Development

All Deep Longevity aging clocks are developed using deep-learning approaches. This method allows Deep Longevity to see age-related trends that escape the attention of other, less sophisticated methods. One of the key advantages of neural networks is the level of personalisation. The Deep Longevity model takes in the whole context of a person's aging trajectory, offers the ways to slow it down and, most importantly, quantifies the future effect of any recommendation. Patients can easily see how much biologically younger they will become if they lower their cholesterol level, reduce fast food intake, or take up dance lessons.

Currently, Deep Longevity holds a patent for the application of deep learning to the aging clock problem (US10325673B2). To date, it has released an mHealth app, "Young.AI", launched several online educational courses and is partnered with longevity clinics in the US and EU. Patents for more specific microbiome and psychological aging clock are pending. In the US, Deep Longevity has filed for "NMN Clock" and "Mind Age" trademarks.

In 2022, Deep Longevity is planning to release several new products, including a mental health application, an EHR system for longevity medicine and new clinical pipelines based on new data types, such as epigenetics. It is also planning to expand its presence in Asia.

Target market

Deep Longevity's services are targeted to all people to discover how much they can do to preserve their health over long periods of time, to experience, achieve and finance superior longevity. An increased healthspan is the freedom to work; when workers are living healthier, longer lives, an aging workforce can be an opportunity to boost economic productivity from employees.

Channels to market

Deep Longevity plans to market through clinics and diagnostics centres. Deep Longevity partner clinics will be able to provide patients with the tools they need to live longer and healthier lives. Deep Longevity already has several package options that work for any size clinic. Deep Longevity already has a longevity medical collaboration with LifeHub and Life Clinic, the largest functional medicine-based medical wellness and medical clinic facilities in Hong Kong. By taking a science-based approach to health optimisation and longevity, they can address physiological imbalances that could stem from nutritional deficiencies or other factors like hormonal imbalances or the effects of environmental pollutants.

Deep Longevity also plans to market to insurance companies; including longevity services in an insurance package will allow the insurance company to give more value to the customer and increase retention.

Success Factors

Team and Reputation

Deep Longevity's team of scientists and AI researchers invented the industry's first-ever aging clocks using deep neural networks and identified aging-related biomarkers for diseases like diabetes, sarcopenia and non-alcoholic steatohepatitis (NASH). After it exited stealth and announced its partnership with Human Longevity Inc (HLI), Deep Longevity was acquired for US$3.79 million by Hong Kong-based Endurance RP, an investment firm specialising in healthcare and late-stage life sciences. This announcement meant that Deep Longevity firmly positioned itself as the gold standard in multi-modal aging clocks. As well having as the largest number of clocks, the company has developed a wealth of experience in building them and applying them to clinical practice. The combined company is set to refocus on longevity and intends to build the first longevity conglomerate working with insurance companies, pharmaceutical companies, healthcare providers and clinics (the proof of concept was previously completed with HLI). After the acquisition in late 2020, Alex Zhavoronkov stepped down as the CEO of Deep Longevity to assume a new role of a Chief Longevity Officer (CLO) at the company. Jim Mellon is now the Chairman of the combined company, and Dr Wei-Wu He has joined as the Director. These changes mean that Deep Longevity is now run by some of the most credible experts in aging and longevity, and together these individuals are well set to create a dedicated and focused longevity company.

Intellectual Property

All Deep Longevity aging clocks are developed using deep-learning approaches and Deep Longevity holds a patent for the application of deep learning to the aging clock problem (US10325673B2). Patents for specific clocks related to the microbiome and psychological aging have been submitted and are pending approval.

Using its IP, Deep Longevity has a range of products such as, health applications, an EHR system for longevity medicine, and new clinical pipelines based on new data types that can penetrate different markets from clinics to insurance companies.

Funding

Led by ETP Ventures and Human Longevity and Performance Impact Venture Fund ("HLPIVF"), Deep Longevity's series A investment round includes participation from BOLD Capital Partners, Longevity Vision Fund, Oculus co-founder and former chief software architect Michael Antonov through Formic Ventures and LongeVC. Deep Longevity also claims celebrity investors in AI and prominent US biotech investors among its undisclosed investors.