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Opinion

The Potential of FinTech as a Digital Biomarker in Neurological Disease

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The societal burden of common neurological conditions such as dementia, Parkinson's disease and stroke continues to rise as populations age. Due to limitations in healthcare system resources, the diagnosis of these disorders and the initiation of treatment is often delayed. Similarly, following diagnosis, access to specialist monitoring for deterioration is frequently inadequate. Pervasive digital technologies such as smartphones, fitness trackers and computer games provide an opportunity for the diagnosis and monitoring of various neurological disorders at scale and in real-time. In Alzheimer's disease, for example, the utility of digital biomarker data has been established in the context of cognitive decline as well as speech and language variability, sleep analysis and gait and movement change etc., [1].

Digital biomarker data which is collected passively, for instance a smartwatch's background recording of step-count, tends to support the acquisition of large amounts of data and is less prone to variability in the user's approach and adherence [1]. In contrast, a prompted request to engage in a particular assessment task (e.g. a computer cognitive test) would be considered an example of active data collection, an approach which better links recorded metrics to the disease correlate but which depends on the engagement of the user, and which generally captures smaller volumes of data [2]. The major drawback of passive data collection is the computational complexity associated with the storage and analysis of large datasets. One area of unrelated innovation offers a potential solution: FinTech, Financial Technologies. FinTech's key components combine big data analytics with machine learning and artificial intelligence in order to support multiple financial services and applications: from personal mobile banking to national, and international, fiscal interoperability platforms. At both a population and individual level, patterns of user data represent a potential source of mapping neurological disease onset and progression.

Dementia, Parkinson's disease and stroke can all lead to changes in cognition, movement and language. The clinical course is typically chronic and progressive over time (in the case of stroke, where small vessel mechanisms of disease are considered). An acute change essentially defines most stroke events but abrupt clinical variations are seen in dementia e.g. with the onset of a superimposed delirium, and with Parkinson's disease, as motor and non-motor symptom fluctuations complicate the mid- and late-phase of the illness. Where might FinTech be most effective when considering the acute and chronic sequelae of these major neurological diseases and how might methodologies develop and react in practice to changes in cognition and speech etc?

When considering the potential of research in this sector it is important to acknowledge the ubiquity of FinTech applications. Everyone handles money and many individuals, now growing into the older age group, are familiar and comfortable with core elements of FinTech including digital banking, money transfer services, price comparison sites etc; robo-advisers and online investment and lending platforms are also a routine part of the day-to-day monetary world. For the wider financial ecosystem, application programming interfaces allow different financial systems to integrate between countries; machine learning is at the center of fraud detection and risk assessment.

The decline in financial decision-making capabilities is an early and disabling element of many neurodegenerative and neurovascular diseases. Defects in cognition are often accompanied by alterations in language skills and muscle function affecting limb dexterity and posture, and strength of vocalization. These disabilities are certain to degrade our interaction with FinTech just as they do with other traditional instrumental activities. Therein lies the problem but also a possible opportunity. In dementia, impaired judgment and information retention leading to inconsistent or duplicated

financial choices represents a potential target for FinTech fraud detection algorithms or a financial chatbot's deep learning and natural language processing responses. In both cases, clinical metrics are extracted passively from everyday interactions. In Parkinsons' disease, while predominantly an illness of physical slowness and tremor, decision making deficits are common due to disorganized executive functioning and at times disinhibited impulse control (where medication side effects prevail). It should be possible to compare the relationship between lapsed or unexpected monetary transactions and aberrations in mobile banking or online trading activity against these symptoms (while at the same time, by way of example, exploring variance in banking app keystroke accuracy and speed to produce a surrogate of Parkinson's motor symptom severity). Likewise, for stroke, biometric aspects of FinTech security provide one avenue of analysis of physical status e.g. through the exploitation of facial recognition in mobile payment verification to detect facial weakness. Moreover, voice biometric AI is powerfully positioned to ambiently assess for stroke speech effects such as dysphasia and dysarthria.

The challenge beyond is not only to establish the pre-clinical correlates which assist with early diagnosis, but to create an environment of clinical remedy to accompany the detection system: the 'machine' sees the cognitive error and corrects it in the understanding that the user has dementia or the beginnings of dementia. A further research aim requires the development of sufficient granularity so that sudden, even life-threatening, acute changes in neurological status, are reliably recognized. The role of FinTech in mitigating delays in diagnosis, and as proxy for specialist monitoring and improved treatment, is an area of vast potential.

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Conflict of Interest

None.

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