

## Machine Learning Based Digitalization of Validated Traditional Cognitive Tests and Their Integration to Multi-User Digital Support System for Alzheimer's Patients

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**Abstract :** It is known that Alzheimer and Dementia are the two most common types of Neurodegenerative diseases and their visibility is getting accelerated for the last couple of years. As the population sees older ages all over the world, researchers expect to see the rate of this acceleration much higher. However, unfortunately, there is no known pharmacological cure for both, although some help to reduce the rate of cognitive decline speed. This is why we encounter with non-pharmacological treatment and tracking methods more for the last five years. Many researchers, including well-known associations and hospitals, lean towards using non-pharmacological methods to support cognitive function and improve the patient's life quality. As the dementia symptoms related to mind, learning, memory, speaking, problem-solving, social abilities and daily activities gradually worsen over the years, many researchers know that cognitive support should start from the very beginning of the symptoms in order to slow down the decline. At this point, life of a patient and caregiver can be improved with some daily activities and applications. These activities include but not limited to basic word puzzles, daily cleaning activities, taking notes. Later, these activities and their results should be observed carefully and it is only possible during patient/caregiver and M.D. in-person meetings in hospitals. These meetings can be quite time-consuming, exhausting and financially ineffective for hospitals, medical doctors, caregivers and especially for patients. On the other hand, digital support systems are showing positive results for all stakeholders of healthcare systems. This can be observed in countries that started Telemedicine systems. The biggest potential of our system is setting the inter-user communication up in the best possible way. In our project, we propose Machine Learning based digitalization of validated traditional cognitive tests (e.g. MOCA, Afazi, left-right hemisphere), their analyses for high-quality follow-up and communication systems for all stakeholders. R. Bakir and G. Kayar are with GefeoSoft, Inc, R&D - Software Development and Health Technologies company. Emails: ramazan, gizem @ gefeoSoft.com This platform has a high potential not only for patient tracking but also for making all stakeholders feel safe through all stages. As the registered hospitals assign corresponding medical doctors to the system, these MDs are able to register their own patients and assign special tasks for each patient. With our integrated machine learning support, MDs are able to track the failure and success rates of each patient and also see general averages among similarly progressed patients. In addition, our platform also supports multi-player technology which helps patients play with their caregivers so that they feel much safer at any point they are uncomfortable. By also gamifying the daily household activities, the patients will be able to repeat their social tasks and we will provide non-pharmacological reminiscence therapy (RT - life review therapy). All collected data will be mined by our data scientists and analyzed meaningfully. In addition, we will also add gamification modules for caregivers based on Naomi Feil's Validation Therapy. Both are behaving positively to the patient and keeping yourself mentally healthy is important for caregivers. We aim to provide a therapy system based on gamification for them, too. When this project accomplishes all the above-written tasks, patients will have the chance to do many tasks at home remotely and MDs will be able to follow them up very effectively. We propose a complete platform and the whole project is both time and cost-effective for supporting all stakeholders.

**Keywords :** alzheimer's, dementia, cognitive functionality, cognitive tests, serious games, machine learning, artificial intelligence, digitalization, non-pharmacological, data analysis, telemedicine, e-health, health-tech, gamification

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