The Parkinson's Disease

The NoTremor Project

The NoTremor Objectives

What is Parkinson's disease?

Parkinson's is a **progressive neurological condition**. People with Parkinson's don't have enough of a chemical called **dopamine** because some nerve cells in their brain have died. Without dopamine people can find that their movements become slower so it takes longer to do things. The main symptoms of Parkinson's are tremor, rigidity and slowness of movement.
There's currently no cure for Parkinson's and we don't yet know why people get the condition.

Parkinson's doesn't directly cause people to die, but symptoms do get worse over time.
Parkinson's disease (PD) is the second most common neurodegenerative disorder after Alzheimer's disease and is expected to impose an increasing social and economic burden on societies as populations age.

Every hour, someone in the UK is told they have Parkinson's...

According to the European Parkinson's Disease Association, **1.2 million people in Europe** have this disease.

The NoTremor Project

NoTremor - Virtual, Physiological and Computational Neuromuscular Models for the Predictive Treatment of Parkinson's Disease - is a EU FP7-ICT funded project, under the grant agreement no: 610391. The project started on the 1st of January 2014 and will last for 36 months.

The overall aim of the project is to provide **patient specific computational models** of the coupled motor and neuromuscular system that will be subsequently used to improve the quality of **analysis, correlation** (of novel and established indicators) and **progression** of **Parkinson's disease.**

In this way, NoTremor will be able to provide **clinical decision support** through a powerful parametric simulation engine, able to provide clinical decision support through a powerful parametric simulation engine, able to **monitor** the **progression of the disease** for individual patients, based on the specific **neurological** and **behavioural** state of the user.

How will we do this?

NoTremor will integrate computational models of the basal ganglia and brainstem into a unique multi-scale parametric computational model that can be subsequently simulated in the NoTremor simulation engine in a physics-based manner.

NoTremor will revolutionize research in the pathophysiology of neurodegenerative movement disorders and provide a novel approach for their analysis founded on a solid computational modelling basis that links midbrain degenerations to motor behaviour. The computational models will be quantified and validated through test campaigns with a very large cohort of PD patients.

By using these novel approaches to research we can develop new patient-specific digital models that will enable us to monitor the disease and how it progresses.

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Research will focus on improving the understanding of low-level functions of the basal ganglia, striatum, the substantia nigra and the interaction of these systems with motor cortex and the brainstem control of the musculoskeletal system.
The patient specific model will be also used as an open virtual patient model repository to boost research on the treatment of PD.
The project will be coupled with existing clinical methodologies for PD characterization and will also propose customized visual analytics tools for the exploration of "hidden" correlations between raw clinical information and associated biomarkers of PD progression and corresponding impact on quality of life.
The specific objectives of **NoTremor** are:

- *Objective 1: Provision of novel patient-specific parametric computational models*
- *Objective 2: Coupled cognitive-motor simulation engine*
- *Objective 3: Inverse simulation for clinical state assessment and progress monitoring*
- *Objective 4: Analytics and new metrics for simulated evaluation and monitoring of medical treatment*
- *Objective 5: Test campaigns with beneficiaries*

Everyone is Different

One of the biggest challenges for treating Parkinson's is the individual and unpredictable nature of the condition.

Parkinson's affects everyone differently – people may experience a wide range of symptoms and the condition progresses in different ways in different people.
The topic of personalised medicine is increasingly becoming a key area for medical experts and researchers to focus on. The NoTremor project is part of this field of research.

The NoTremor Architecture

NoTremor

The NoTremor Conceptual Architecture

The NoTremor consists of two architectural layers:
• The **application layer**, which is responsible for providing the simulation mechanisms of the brain neurons and body muscles, as well as reporting to the NoTremor user any necessary information during the simulation. It consists of six main components, a) the **Brain model**, which is responsible for the neuron signal management and brain functionality, b) the **Nervous system orchestration module**, which parts the computational interface between the brain model, the musculoskeletal model and the peripheral nervous system, c) **Peripheral nervous system**, which contains lumped models contributing to the moto-neuron dynamics, d) the **Musculoskeletal model**, which is responsible for the management of the muscles contractions and body movement simulation, e) **Simulation reporter and the f)** analytics module.
• The **data layer**, which provides to the application layer components the needed dataset (e.g. sensing measurements, DBS and fMRI data, etc.)
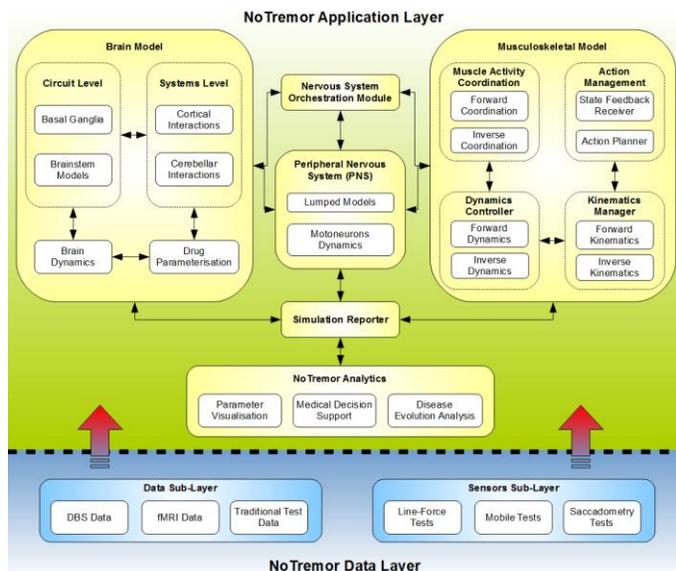
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Parkinson's Disease Society of the United Kingdom LBG (Parkinson's UK)

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Further information

For more information on the 3-year EU-funded **NoTremor** project, visit the website:
www.notremor.eu
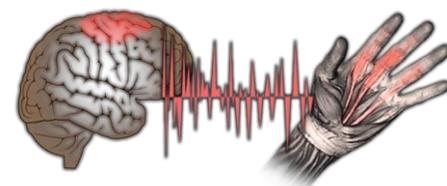
closer to a cure

NoTremor

Virtual, Physiological and Computational Neuromuscular Models for the Predictive Treatment of Parkinson's Disease

Find out how this new EU funded project is going to improve the treatment of Parkinson's disease

SEVENTH FRAMEWORK PROGRAMME