PROJECT DEPLOYMENT PHASE

PARKINSON'S ANALYSIS

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Team ID	PNT2022TMID28464
Project Name	Detecting Parkinson's Disease Using Machine Learning

PARKINSON'S DISEASE

Parkinson's disease is a brain disorder that causes unintended or uncontrollable movements, such as shaking, stiffness, and difficulty with balance and coordination.

Symptoms usually begin gradually and worsen over time. As the disease progresses, people may have difficulty walking and talking. They may also have mental and behavioral changes, sleep problems, depression, memory difficulties, and fatigue.

While virtually anyone could be at risk for developing Parkinson's, some research studies suggest this disease affects more men than women. It's unclear why, but studies are underway to understand factors that may increase a person's risk. One

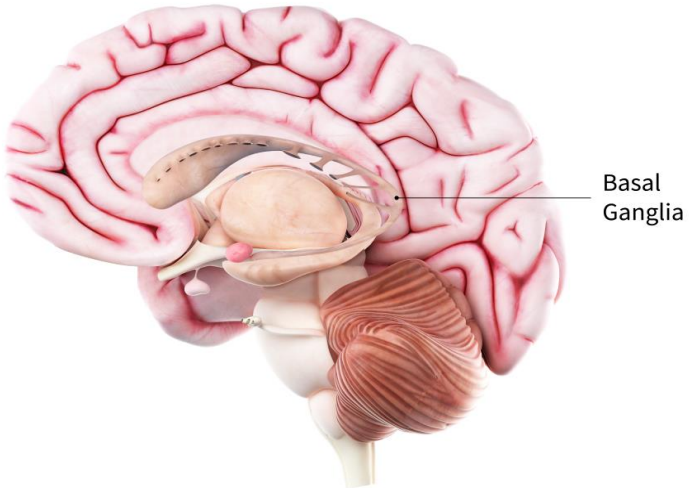
clear risk is age: Although most people with Parkinson's first develop the disease after age 60, about 5% to 10% experience onset before the age of 50. Early-onset forms of Parkinson's are often, but not always, inherited, and some forms have been linked to specific gene mutations.

CAUSES:

The most prominent signs and symptoms of Parkinson's disease occur when nerve cells in the basal ganglia, an area of the brain that controls movement, become impaired and/or die. Normally, these nerve cells, or neurons, produce an important brain chemical known as dopamine. When the neurons die or become impaired, they produce less dopamine, which causes the movement problems associated with the disease. Scientists still do not know what causes the neurons to die.

Many brain cells of people with Parkinson's disease contain Lewy bodies, unusual clumps of the protein alpha-synuclein. Scientists are trying to better understand the normal and abnormal functions of alpha-synuclein and its relationship to genetic mutations that impact Parkinson's and Lewy body dementia.

Some cases of Parkinson's disease appear to be hereditary, and a few cases can be traced to specific genetic mutations. While genetics is thought to play a role in Parkinson's, in most cases the disease does not seem to run in families. Many researchers now believe that Parkinson's results from a combination of genetic and environmental factors, such as exposure to toxins.



SYMPTOMS OF PARKINSON'S DISEASE:

Parkinson's has four main symptoms:

- Tremor in hands, arms, legs, jaw, or head
- Muscle stiffness, where muscle remains contracted for a long time
- Slowness of movement
- Impaired balance and coordination, sometimes leading to falls

Other symptoms may include:

- Depression and other emotional changes
- Difficulty swallowing, chewing, and speaking
- Urinary problems or constipation
- Skin problems

DIAGNOSIS OF PARKINSON'S DISEASE:

There are currently no blood or laboratory tests to diagnose non-genetic cases of Parkinson's. Doctors usually diagnose the disease by taking a person's medical history and performing a neurological examination. If symptoms improve after starting to take medication, it's another indicator that the person has Parkinson's.

A number of disorders can cause symptoms similar to those of Parkinson's disease. People with Parkinson's-like symptoms that result from other causes, such as multiple system atrophy and dementia with Lewy bodies, are sometimes said to have parkinsonism. While these disorders initially may be misdiagnosed as Parkinson's, certain medical tests, as well as response to drug treatment, may help to better evaluate the cause. Many other diseases have similar features but require different treatments, so it is important to get an accurate diagnosis as soon as possible.

TREATMENTS FOR PARKINSON'S DISEASE:

Although there is no cure for Parkinson's disease, medicines, surgical treatment, and other therapies can often relieve some symptoms. Medicines can help treat the symptoms of Parkinson's by:

- Increasing the level of dopamine in the brain
- Having an effect on other brain chemicals, such as neurotransmitters, which transfer information between brain cells
- Helping control non-movement symptoms

The main therapy for Parkinson's is levodopa. Nerve cells use levodopa to make dopamine to replenish the brain's dwindling supply.

- Dopamine agonists to stimulate the production of dopamine in the brain
- Enzyme inhibitors (e.g., MAO-B inhibitors, COMT inhibitors) to increase the amount of dopamine by slowing down the enzymes that break down dopamine in the brain
- Amantadine to help reduce involuntary movements
- Anticholinergic drugs to reduce tremors and muscle rigidity

MACHINE LEARNING IN DIAGNOSIS:

The researchers found that the drawing speed was slower and the pen pressure is lower among Parkinson's patients. One of the indications of Parkinson's is tremors and rigidity in the muscles, making it difficult to draw smooth spirals and waves. It is possible to detect Parkinson's disease using the drawings alone instead of measuring the speed and pressure of the pen on paper. Our goal is to quantify the visual appearance(using HOG method) of these drawings and then train a machine learning model to classify them. In this project, we are using, Histogram of Oriented Gradients (HOG) image descriptor along with a Random Forest classifier to automatically detect Parkinson's disease in hand-drawn images of spirals and waves.

SPIRAL AND WAVE DIAGRAMS:

Spiral diagrams:

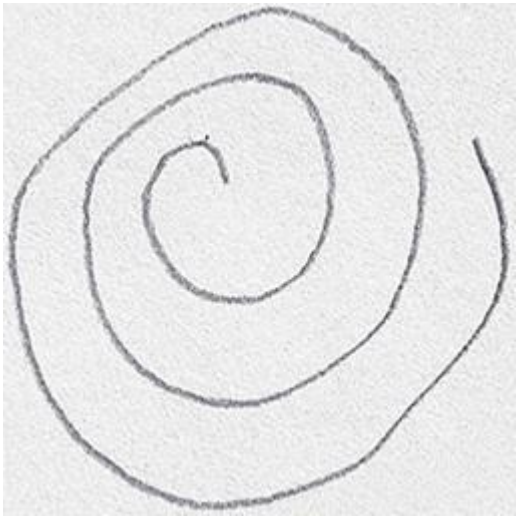


Fig 1.1 healthy person

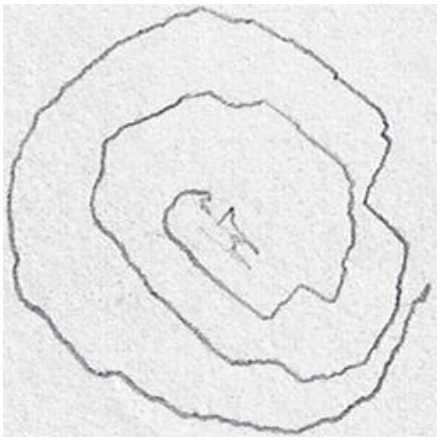


Fig 1.2 parkinson person

Wave diagrams:

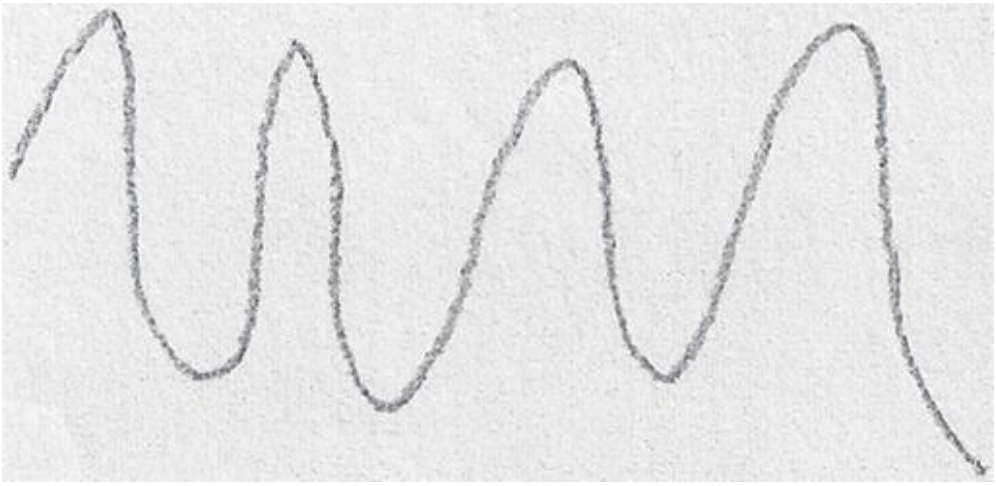


Fig 1.3 healthy person

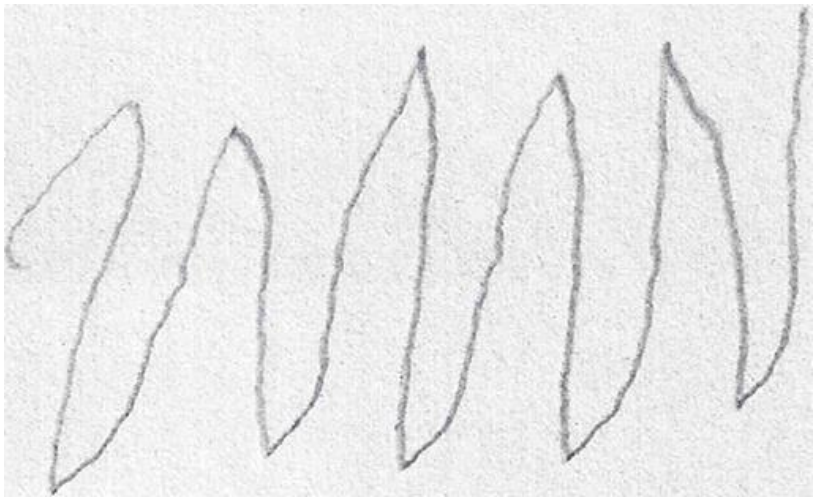


Fig 1.4 parkinson person

CENSUS RESULTS IN INDIA:

Parkinson's disease (PD) is the second most common neurodegenerative disorder in adults over the age of 60 years. According to the Global Burden of Disease study (2018), the worldwide burden of PD has more than doubled over the past two decades from 2.5 million patients in 1990–6.1 million patients in 2016. India is home to nearly 0.58 million persons living with PD as estimated in 2016, with an expected major increase in prevalence in the coming years. Despite the large number of people affected with PD, insights into the underlying genetic and environmental risk factors specific to the Indian population are limited.

About 5–10% of PD is monogenic and inherited in an autosomal dominant or recessive manner. The large majority of patients have a sporadic disease. To date, 90 PD loci have been identified explaining a missing heritability in a range of 16–36%. It is also increasingly recognized that additional loci with varying degrees of minor allele frequency and effect size remain to be discovered which might account for the remaining missing heritability.