

Voice Parameters & What They Indicate (Parkinson's Context)

These features are **biomarkers of vocal motor control**, which is affected early in Parkinson's disease.

1. Fundamental Frequency (Pitch)

Parameter	What it measures	What it indicates
MDVP:Fo(Hz)	Average pitch	Overall vocal cord vibration rate
MDVP:Fhi(Hz)	Maximum pitch	Pitch instability / vocal control
MDVP:Flo(Hz)	Minimum pitch	Reduced pitch range (monotonic speech)

In Parkinson's:

Reduced pitch range and unstable control of vocal folds

2. Jitter (Frequency Instability)

Measures **cycle-to-cycle pitch variation**

Parameter	Meaning
MDVP:Jitter(%)	Relative pitch instability
MDVP:Jitter(Abs)	Absolute pitch variation
MDVP:RAP	Short-term pitch variation
MDVP:PPQ	Pitch perturbation
Jitter:DDP	Combined jitter measure

In Parkinson's:

Higher jitter = poor neuromuscular control
Indicates vocal tremor & rigidity

3. Shimmer (Amplitude Instability)

Measures **cycle-to-cycle loudness variation**

Parameter	Meaning
MDVP:Shimmer	Loudness instability
MDVP:Shimmer(dB)	Amplitude variation (dB)
Shimmer:APQ3 / APQ5 / APQ	Loudness perturbation
Shimmer:DDA	Combined shimmer metric

In Parkinson's:

Soft, breathy, unstable voice
Reduced respiratory & laryngeal control

4. Noise Measures (Voice Quality)

Parameter	What it measures	Interpretation
NHR	Noise-to-Harmonic Ratio	Breathiness / hoarseness
HNR	Harmonic-to-Noise Ratio	Vocal clarity

In Parkinson's:

↑ NHR and ↓ HNR
Indicates weak vocal fold closure

5. Non-linear & Complexity Measures

(VERY important for early PD detection)

Parameter	What it indicates
RPDE	Irregularity of vocal fold vibration
DFA	Loss of natural voice complexity
spread1 / spread2	Pitch distribution irregularity
PPE	Pitch Period Entropy (pitch unpredictability)

In Parkinson's:

Voice becomes **less complex, more rigid**
These features are **strong early biomarkers**

6. Clinical Severity Targets (Telemonitoring Dataset)

Parameter	Meaning
motor_UPDRS	Motor symptom severity
total_UPDRS	Overall Parkinson's severity

Used for regression, not classification.

7. Demographic & Metadata Features

Parameter	Purpose
subject#	Patient ID
age	Risk stratification
sex	Gender-based voice differences
test_time	Disease progression tracking

Summary Table (Quick Reference)

Feature Type	What it Detects
Pitch (Fo)	Reduced vocal flexibility
Jitter	Neuromuscular instability
Shimmer	Weak respiratory/laryngeal control
Noise ratios	Hoarseness & breathiness
Nonlinear metrics	Early neurodegeneration
UPDRS	Clinical disease severity