Constructing artificial features with Grammatical Evolution for the motor symptoms of Parkinson's Disease

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Abstract: This study introduces a set of features designed to capture the motor symptoms of Parkinson's Disease (PD) through detailed motion analysis, with a specific focus on how these symptoms change before and after medication. The features reflect key aspects of patient movement, such as tremor intensity, slowness, rigidity, instability, and irregularity in motion patterns. By quantifying how consistently and smoothly a patient performs specific tasks, the features provide insight into motor control quality and neurological function. Crucially, they are labeled according to the patient's state—before and after receiving medication—allowing for a clear comparison of treatment effects. This enables not only objective tracking of symptom severity, but also evaluation of medication responsiveness. These features address a fundamental clinical need: moving beyond subjective observation toward continuous, data-driven monitoring of disease progression and therapeutic effectiveness in Parkinson's Disease. In the current work the impact of feature construction using Grammatical Evolution on previously mentioned features in evaluated. We compare traditional neural architectures (MLP with ADAM, MLP with Genetic Algorithm, and RBF networks) against models trained on artificially constructed features. The results demonstrate a substantial reduction in classification error when 2 to 5 constructed features are used, achieving the lowest error rate (14.33%) with four generated features (FC4GEN), compared to 38.65% for the best baseline model (RBF). These findings highlight the effectiveness of evolutionary feature construction in enhancing classification accuracy.

Keywords: Machine learning; Evolutionary algorithms; Genetic Programming; Grammatical Evolution

1. Introduction

2. Materials and Methods

3. Results

4. Conclusions

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