

Exploring factors associated with severe cognitive fatigue symptoms in multiple sclerosis: A decision-tree approach

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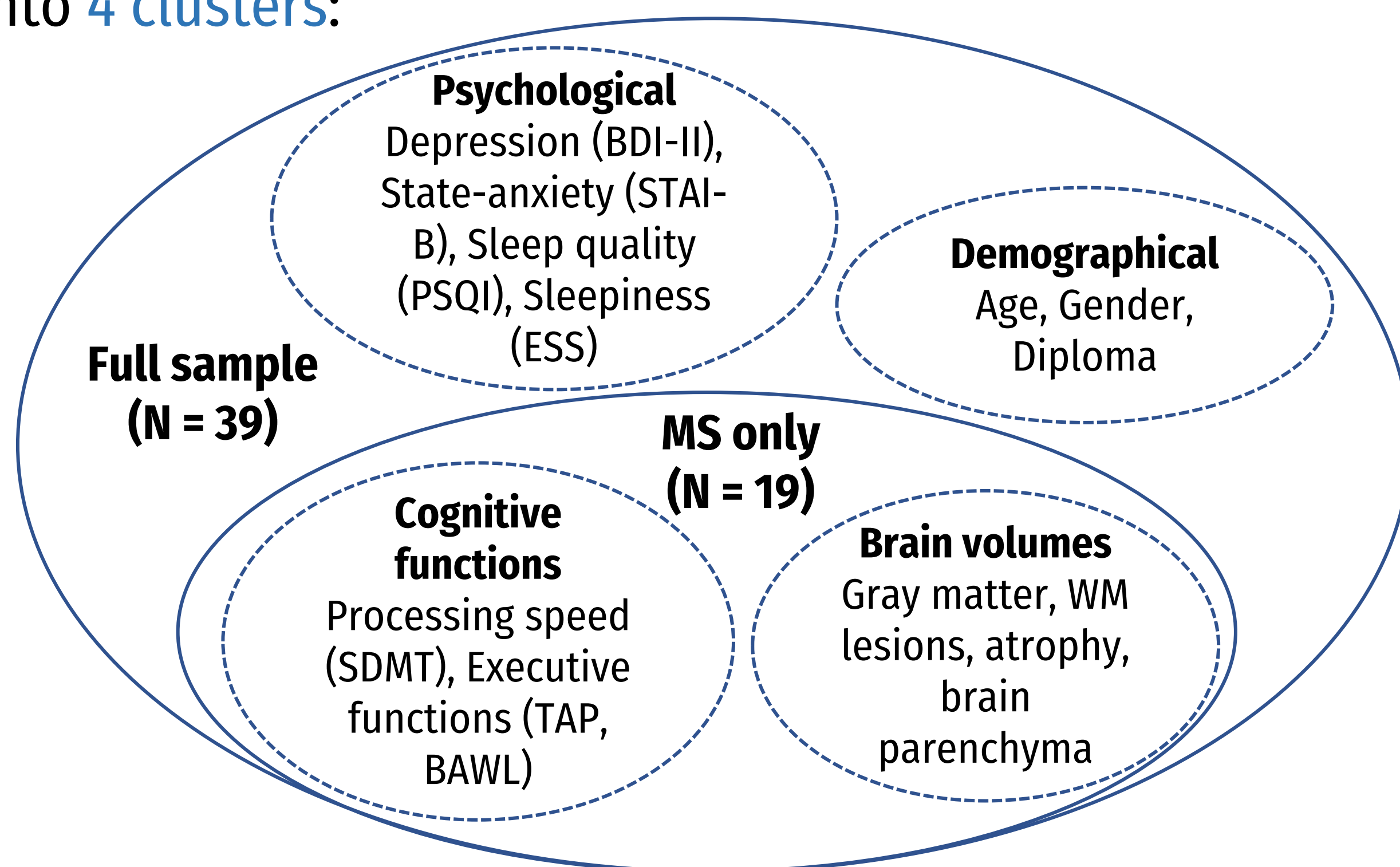
Introduction

Cognitive fatigue (CF) is one of the most disabling symptoms in multiple sclerosis (MS)¹. Unfortunately, the underlying mechanisms of MS-fatigue are not fully understood yet. If associated risk factors have been identified², their interactions remain largely unexplored.

As, the ability to **predict CF severity** based on the presence of interacting risk factors could be of great use in clinical practice, the goal of this study is to use a **decision-tree model** to explore relationships between variables associated with severe CF.

Simulation methodology

CF severity, ranging from mild to severe, was assessed with CF categorical subscale of the Fatigue Scale for Motor and Cognitive Functions (FSMC)³. Data from a total of **18 explanatory variables** were also collected and dispatched into **4 clusters**:



Decision-tree were implemented in MATLAB[®] for each cluster separately. Target variable was the categorical severity score of FSMC cognitive subscale. Main parameters were as follows:

MaxNumSplit = N - 1

LeafSize = 1

ParentSize = 5

Statistical analysis

Correlations between **CF severity scores** and all variables of interest were examined. Clusters were not kept in the analysis if none of their components displayed significant correlation ($p < .05$). **Level of education, depressive mood, state-anxiety** and **sleepiness** showed significant correlations ($p < .05$) with CF subscale of FSMC. Decision-tree were built on **two clusters**.

Conclusions

Lower education level seems to determine CF severity beyond the presence of the disease, suggesting that cognitive reserve may protect against severe CF^{4,5}. Besides, **depressive affects** could be the main predictor of severe CF in MS^{3,6}; severe CF could also arise from the interaction between depressive mood and a **high level of anxiety** in healthy subjects. Finally, **excessive daytime sleepiness** could be linked with a risk of developing moderate CF symptoms⁶, in both groups.

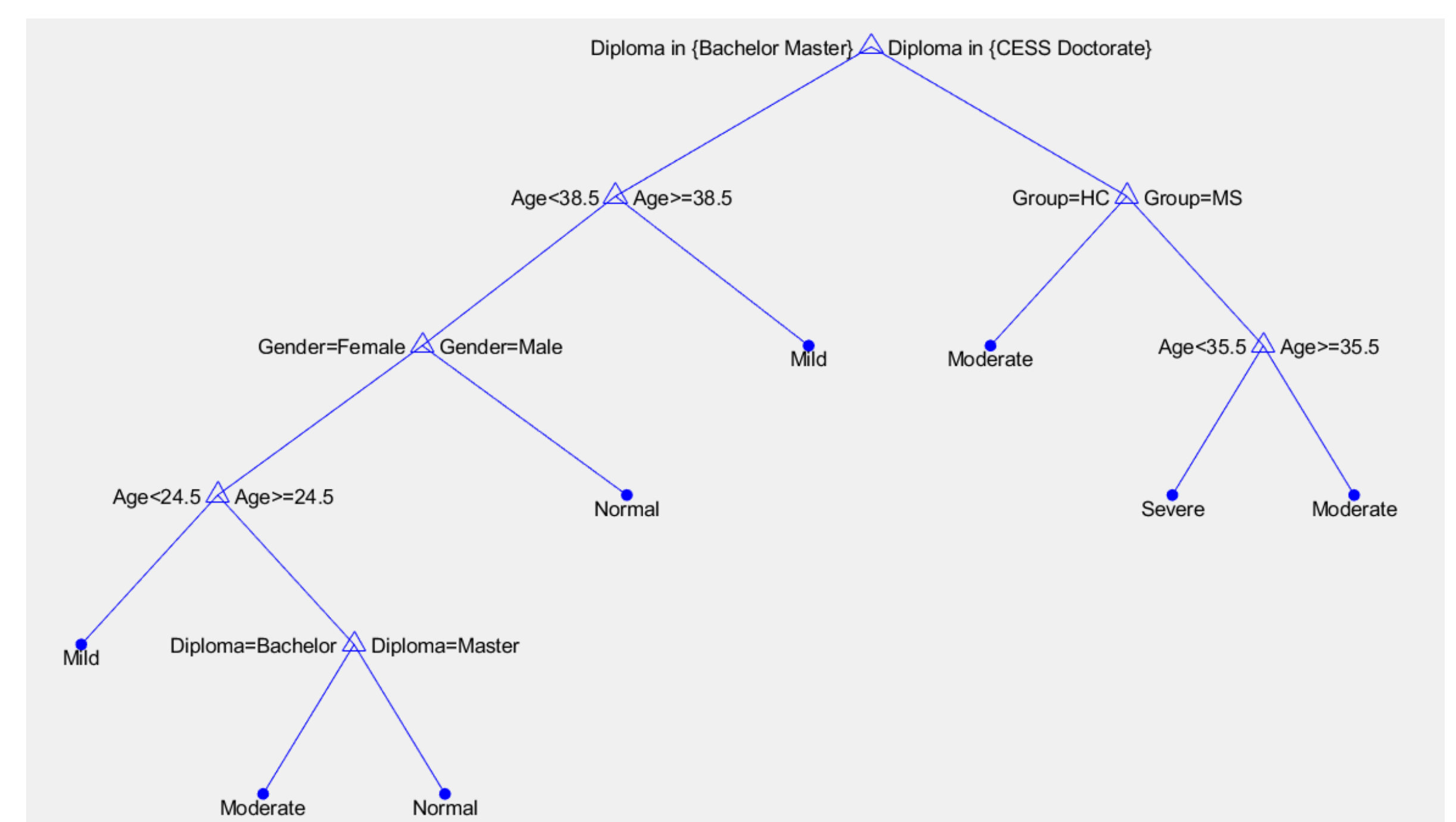
Unfortunately, the model could not be validated with a new sample of individuals. Thus, the results need confirmation with a larger dataset. Nevertheless, this study demonstrates that decision-tree models are a **promising tool to objectively predict CF symptoms** in patients with MS.

Participants

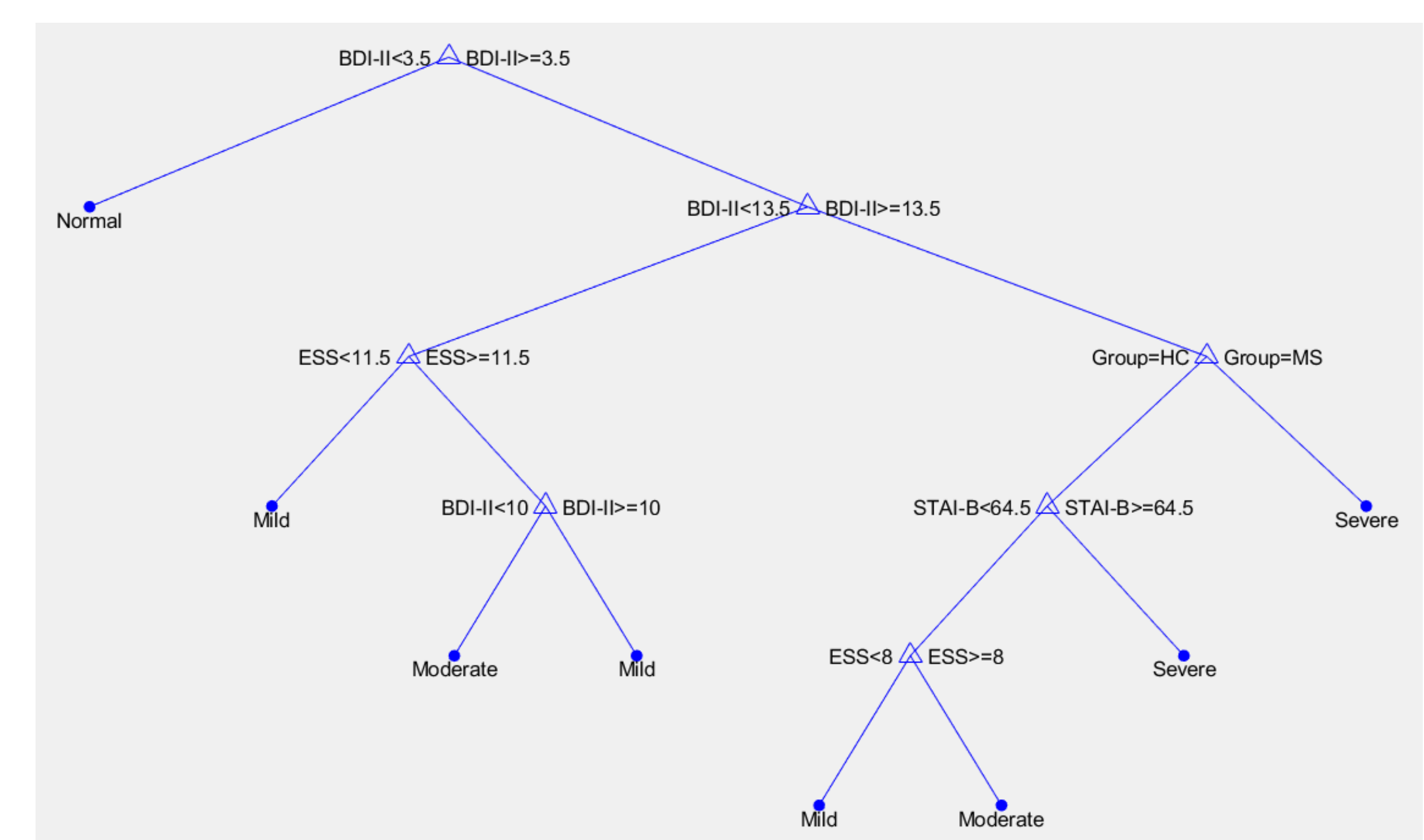
	Patients* (N ₁ = 19)	Controls (N ₂ = 20)
Age (years)	31.58	31.10
Mean (Std)	(5.23)	(5.78)
Education (years)	14.26	14.75
Mean (Std)	(2.05)	(1.58)
Women proportion (%)	73	70

* Disease duration (MS) < 5 years

Decision-Tree Results



Severe CF symptoms are predicted for less educated patients under the age of 35.5 years old, whereas moderate symptoms are predicted for less educated healthy controls. Results for Doctorate degree most likely reflect modelisation of noise.



Severe CF symptoms are predicted for MS patients with depressive mood, and for healthy subjects if they also experience high anxiety.

Moderate CF symptoms are predicted for subjects with excessive daytime sleepiness (ESS > 8 and > 11,5 for subjects with and without mood disorders, respectively).

First attempt to validate the model showed fragility of the results ($p_{\text{error}} = 0.57$).