

**Exploring Neutrosophic Set Variants: Investigating  
Topological Insights, Approximation Spaces and  
Decision-Making Approaches**

*The thesis submitted in partial fulfilment of the degree of*

**DOCTOR OF PHILOSOPHY  
in  
MATHEMATICS**

*By*

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## **80\_RECOMMENDATION**

- Exploring lower and higher separation axioms, convergence properties, and compactness.
- Implementing the validated theoretical concepts, initially demonstrated through assumed numerical examples, in a practical, real-time application specifically in pattern recognition and machine learning.