

Fuzzy Logic – Ayush Shah

- Models reasoning with values which range from 0 to 1 where 0 will be totally false and 1 will be totally true
- Fuzzy variables will be union, intersection and complement which will be used to conduct fuzzy operations
- Basic language features will be variables, expressions, assignments, scopes and evaluation of fuzzy logic operations
- Operations:
 - Union: takes max of 2 values by combining 2 fuzzy sets and taking max value of each element, union OR
 - Intersection: takes min of 2 values by combining 2 fuzzy sets and taking min value of each element, intersection AND
 - Complement: the degree of each element gets inverted in the set so $1 - \text{value}$, NOT
 - Addition: 2 fuzzy sets are added and capacity is set at 1
 - Multiplication: 2 fuzzy sets are multiplied element wise
 - Variable Assignment: values are assigned to variables and can be used later
- Design:
 - FuzzyOperation enum in the FuzzyEval outlines the core of the program where and how each case showcases the operations that can be evaluated
 - Can be expanded to add more operations
 - The eval function in FuzzyEval is to evaluate fuzzy expressions where it uses mutable.Map to store variable assignments

- Works recursively for variables
 - It will match FuzzyOperation patterns in order to evaluate
 - Assign also gets used to store variables for future access
 - Using mutable Map also makes future access easier and efficient
- Testing: use **sbt test** to test the program
 - Ensures features are working and key operations are executed properly
- Limitations:
 - Error responses: currently, it just throws an exception if no variables is not found.
It could give better error responses
 - Operations: currently, the operations are limited so it could be extended in the future to include additional operations
- System requirements:
 - Scala 3.3.0 or better
 - SBT
 - ScalaTest plugin
 - Git clone and compile
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