Un sistema experto de lógica difusa para la predicción de acciones

Hernandez Aceves Adolfo Yahir

Introducción

Este programa utiliza los principios de la lógica difusa para predecir las tendencias del mercado de valores.

El proyecto fue creado para que inversionista y analistas pudieran tener una base solida e intuitiva para poder tomar decisiones basadas en las inferencias de la lógica difusa.

Este programa calcula el incremento o decremento del precio basado en las entradas ingresadas.

Definición de variables

```python
#fuzzy variables
profit_margin_fuzz = ctrl.Antecedent(np.arange(-200, 201, 1), 'Profit Margin')
debt_ratio_fuzz = ctrl.Antecedent(np.arange(0, 101, 1), 'Debt Ratio')
roa_fuzz = ctrl.Antecedent(np.arange(-100, 101, 1), 'ROA')
price_var_fuzz = ctrl.Consequent(np.arange(-100, 201, 1), 'PRICE VAR [%]')
```

Definición de variables

```
##TRAPEZOIDAL
profit_margin_fuzz['very low'] = fuzz.trapmf(profit_margin_fuzz.universe, [-200, -200, -150, -50])
profit_margin_fuzz['low'] = fuzz.trapmf(profit_margin_fuzz.universe, [-100, -50, 0, 50])
profit_margin_fuzz['medium'] = fuzz.trapmf(profit_margin_fuzz.universe, [0, 25, 75, 100])
profit_margin_fuzz['high'] = fuzz.trapmf(profit_margin_fuzz.universe, [50, 100, 150, 200])
profit_margin_fuzz['very high'] = fuzz.trapmf(profit_margin_fuzz.universe, [150, 200, 200, 200])

debt_ratio_fuzz['very low'] = fuzz.trapmf(debt_ratio_fuzz.universe, [0, 0, 10, 20])
debt_ratio_fuzz['low'] = fuzz.trapmf(debt_ratio_fuzz.universe, [10, 20, 40, 50])
debt_ratio_fuzz['medium'] = fuzz.trapmf(debt_ratio_fuzz.universe, [30, 40, 60, 70])
debt_ratio_fuzz['high'] = fuzz.trapmf(debt_ratio_fuzz.universe, [50, 60, 80, 90])
debt_ratio_fuzz['very high'] = fuzz.trapmf(debt_ratio_fuzz.universe, [80, 90, 100, 100])

roa_fuzz['very low'] = fuzz.trapmf(roa_fuzz.universe, [-100, -100, -75, -25])
roa_fuzz['low'] = fuzz.trapmf(roa_fuzz.universe, [-50, -25, 0, 25])
roa_fuzz['medium'] = fuzz.trapmf(roa_fuzz.universe, [0, 10, 30, 40])
roa_fuzz['high'] = fuzz.trapmf(roa_fuzz.universe, [20, 30, 50, 60])
roa_fuzz['very high'] = fuzz.trapmf(roa_fuzz.universe, [50, 60, 100, 100])

price_var_fuzz['big decrease'] = fuzz.trapmf(price_var_fuzz.universe, [-100, -100, -75, -75])
price_var_fuzz['decrease'] = fuzz.trapmf(price_var_fuzz.universe, [-75, -60, -40, -10])
price_var_fuzz['stable'] = fuzz.trapmf(price_var_fuzz.universe, [-10, -10, 10, 10])
price_var_fuzz['increase'] = fuzz.trapmf(price_var_fuzz.universe, [10, 40, 60, 80])
price_var_fuzz['big increase'] = fuzz.trapmf(price_var_fuzz.universe, [80, 120, 200, 200])
```

Reglas

```python
# Profit Margin: Very Low
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very low'] & roa_fuzz['very low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very low'] & roa_fuzz['low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very low'] & roa_fuzz['medium'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very low'] & roa_fuzz['high'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very low'] & roa_fuzz['very high'], price_var_fuzz['decrease']),

ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['low'] & roa_fuzz['very low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['low'] & roa_fuzz['low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['low'] & roa_fuzz['medium'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['low'] & roa_fuzz['high'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['low'] & roa_fuzz['very high'], price_var_fuzz['decrease']),

ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['medium'] & roa_fuzz['very low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['medium'] & roa_fuzz['low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['medium'] & roa_fuzz['medium'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['medium'] & roa_fuzz['high'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['medium'] & roa_fuzz['very high'], price_var_fuzz['decrease']),

ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['high'] & roa_fuzz['very low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['high'] & roa_fuzz['low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['high'] & roa_fuzz['medium'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['high'] & roa_fuzz['high'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['high'] & roa_fuzz['very high'], price_var_fuzz['decrease']),

ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very high'] & roa_fuzz['very low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very high'] & roa_fuzz['low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very high'] & roa_fuzz['medium'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very high'] & roa_fuzz['high'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['very low'] & debt_ratio_fuzz['very high'] & roa_fuzz['very high'], price_var_fuzz['big decrease']),
```

Reglas

```
# Profit Margin: Low
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very low'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very low'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very low'] & roa_fuzz['medium'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very low'] & roa_fuzz['high'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very low'] & roa_fuzz['very high'], price_var_fuzz['stable']),

ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['low'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['low'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['low'] & roa_fuzz['medium'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['low'] & roa_fuzz['high'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['low'] & roa_fuzz['very high'], price_var_fuzz['stable']),

ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['medium'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['medium'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['medium'] & roa_fuzz['medium'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['medium'] & roa_fuzz['high'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['medium'] & roa_fuzz['very high'], price_var_fuzz['stable']),

ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['high'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['high'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['high'] & roa_fuzz['medium'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['high'] & roa_fuzz['high'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['high'] & roa_fuzz['very high'], price_var_fuzz['stable']),

ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very high'] & roa_fuzz['very low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very high'] & roa_fuzz['low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very high'] & roa_fuzz['medium'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very high'] & roa_fuzz['high'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['low'] & debt_ratio_fuzz['very high'] & roa_fuzz['very high'], price_var_fuzz['stable']),
```

Reglas

```python
# Profit Margin: Medium
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very low'] & roa_fuzz['very low'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very low'] & roa_fuzz['low'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very low'] & roa_fuzz['medium'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very low'] & roa_fuzz['high'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very low'] & roa_fuzz['very high'], price_var_fuzz['increase']),

ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['low'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['low'] & roa_fuzz['low'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['low'] & roa_fuzz['medium'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['low'] & roa_fuzz['high'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['low'] & roa_fuzz['very high'], price_var_fuzz['increase']),

ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['medium'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['medium'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['medium'] & roa_fuzz['medium'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['medium'] & roa_fuzz['high'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['medium'] & roa_fuzz['very high'], price_var_fuzz['stable']),

ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['high'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['high'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['high'] & roa_fuzz['medium'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['high'] & roa_fuzz['high'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['high'] & roa_fuzz['very high'], price_var_fuzz['decrease']),

ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very high'] & roa_fuzz['very low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very high'] & roa_fuzz['low'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very high'] & roa_fuzz['medium'], price_var_fuzz['big decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very high'] & roa_fuzz['high'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['medium'] & debt_ratio_fuzz['very high'] & roa_fuzz['very high'], price_var_fuzz['decrease']),
```

Reglas

```python
# Profit Margin: High
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very low'] & roa_fuzz['very low'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very low'] & roa_fuzz['low'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very low'] & roa_fuzz['medium'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very low'] & roa_fuzz['high'], price_var_fuzz['big increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very low'] & roa_fuzz['very high'], price_var_fuzz['big increase']),

ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['low'] & roa_fuzz['very low'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['low'] & roa_fuzz['low'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['low'] & roa_fuzz['medium'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['low'] & roa_fuzz['high'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['low'] & roa_fuzz['very high'], price_var_fuzz['big increase']),

ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['medium'] & roa_fuzz['very low'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['medium'] & roa_fuzz['low'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['medium'] & roa_fuzz['medium'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['medium'] & roa_fuzz['high'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['medium'] & roa_fuzz['very high'], price_var_fuzz['increase']),

ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['high'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['high'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['high'] & roa_fuzz['medium'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['high'] & roa_fuzz['high'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['high'] & roa_fuzz['very high'], price_var_fuzz['stable']),

ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very high'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very high'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very high'] & roa_fuzz['medium'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very high'] & roa_fuzz['high'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['high'] & debt_ratio_fuzz['very high'] & roa_fuzz['very high'], price_var_fuzz['stable']),
```

Reglas

```python
# Profit Margin: Very High
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very low'] & roa_fuzz['very low'], price_var_fuzz['big increase'])
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very low'] & roa_fuzz['low'], price_var_fuzz['big increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very low'] & roa_fuzz['medium'], price_var_fuzz['big increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very low'] & roa_fuzz['high'], price_var_fuzz['big increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very low'] & roa_fuzz['very high'], price_var_fuzz['big increase']

ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['low'] & roa_fuzz['very low'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['low'] & roa_fuzz['low'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['low'] & roa_fuzz['medium'], price_var_fuzz['big increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['low'] & roa_fuzz['high'], price_var_fuzz['big increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['low'] & roa_fuzz['very high'], price_var_fuzz['big increase']),

ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['medium'] & roa_fuzz['very low'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['medium'] & roa_fuzz['low'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['medium'] & roa_fuzz['medium'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['medium'] & roa_fuzz['high'], price_var_fuzz['big increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['medium'] & roa_fuzz['very high'], price_var_fuzz['big increase']),

ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['high'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['high'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['high'] & roa_fuzz['medium'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['high'] & roa_fuzz['high'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['high'] & roa_fuzz['very high'], price_var_fuzz['increase']),

ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very high'] & roa_fuzz['very low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very high'] & roa_fuzz['low'], price_var_fuzz['decrease']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very high'] & roa_fuzz['medium'], price_var_fuzz['stable']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very high'] & roa_fuzz['high'], price_var_fuzz['increase']),
ctrl.Rule(profit_margin_fuzz['very high'] & debt_ratio_fuzz['very high'] & roa_fuzz['very high'], price_var_fuzz['increase']),
```

Repositorio

https://github.com/hrayrdb/Stock-Prediction