HW #1. Fuzzy Adaptive Resonance Theory


- Using the skeleton codes and referring to the procedure on p.3 of this ppt, fill the following 4 functions in ‘Fill’ folder:
  - complementCoding.m
  - activateART.m
  - matchART.m
  - updateART.m

- In the report, discuss the following issues:
  - Deeper searches of previously coded categories with initial weights \( w_{ji} > 1 \) (p.39).
  - The classification performance w.r.t. \( \alpha, \beta, \) and \( \rho \) (p.40)
    - Fast-commit slow-recode option (p.43).
    - Conservative limit by taking \( \alpha \rightarrow 0 \) to minimize recoding during learning (p.46).
    - The performance for one-shot stable learning (p.49).
  - Complement coding for pattern generalization while avoiding the category proliferation problem (p.44)

- Develop your own ART network as a variation of the Fuzzy ART
Submit the report along with *main.m* and the 4 programmed functions by zip file name: HW1_yourname.zip

- Due date: March 27, 2016
- Send to: yhyoo@rit.kaist.ac.kr
Fuzzy ART procedure

- Complement coding (complementCoding.m)
  - Let \( l = (l_1, l_2, \ldots, l_n) \) denote an input vector
  - Let \( x = (l, \bar{l}) \) be the activity vector \((\bar{l} = 1 - l)\)

- Code activation (activateART.m)
  - \( T_j = \frac{|x \land w_j|}{\alpha + |w_j|} \), where \( \alpha \) is a bias, \( w_j \) is a weight vector that is linked to \( y_j \)

- Code competition
  - \( T_j = \max\{T_j: \text{for all } F_2 \text{ node } j\} \)

- Template matching (MatchART.m)
  - \( m_j = \frac{|x \land w_j|}{|x|} \geq \rho \), where \( \rho \) is a vigilance parameter

- Template learning (updateART.m)
  - Select all \( i \) that satisfy \( x_i < w_{ij} \)
  - \( w_{ij} = \beta x_i + (1 - \beta)w_{ij} \)
Results

Original Input

Learning rate: 0.5, vigilance: 0.2

Learning rate: 0.5, vigilance: 0.5

Learning rate: 0.5, vigilance: 0.8