Analytical Thinking

ISTE-600

Midterm Review

Class 1. Analytical Thinking

- Lesson 1
  - Basic Concepts of Analytical Thinking
- Lesson 2
  - Elements and Standards Online Learning Tool
- Lesson 3:
  - Other Thinking's

Class 1.Lesson 1
Basic Concepts: Analytical thinking

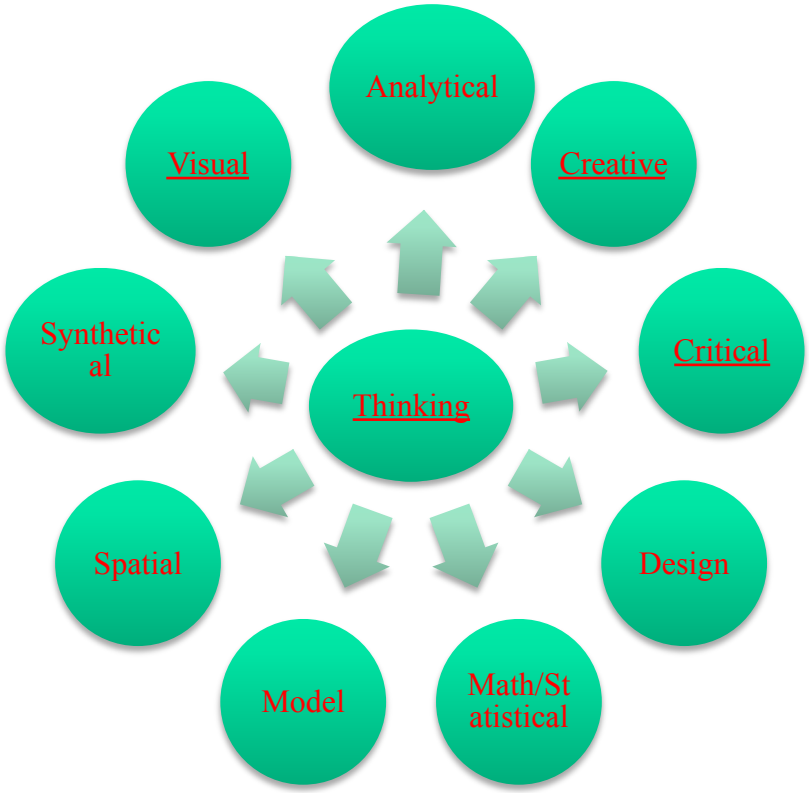
- Analytical Thinking
  - Elements of Thinking (Reasoning)
  - Standards of Thinking
  - Examples
  - Ref.
    - http://www.criticalthinking.org/
    - Analytic Thinking, 2nd edition by Linda Elder and Richard Paul
      http://www.criticalthinking.org/store/products/analytic-thinking-2nd-edition/171

Class 1.Lesson 2
Elements and Standards Online Learning Tool

- Online Learning Tool
- Identification of Elements of Thought
- Questions of Elements of Thought
- A Checklist for Reasoning
- Standards of Thinking
  - Evaluation & Assessment of Thinking
- Ref.
  - http://www.criticalthinking.org/
  - Analytic Thinking, 2nd edition by Linda Elder and Richard Paul
    http://www.criticalthinking.org/store/products/analytic-thinking-2nd-edition/171

Class 1. Lesson 3: Other Thinking's

- Other Thinking's
  - Synthetical
  - Systemic
  - Critical
  - Creative
  - Statistical
  - Visual
  - Computational
- Analytical vs. Other Thinking's



Class 2. Introduction to Data Mining

- Lesson 1
  - Definition & Process
  - Data Mining Challenges
  - Tools: Weka & Tableau
- Lesson 2
  - Data Mining Techniques
    - Supervised Learning
    - Unsupervised Algorithms

Class 2.Lesson 1
Overview & Challenges

- Why Mine Data?
- What is Data Mining?
- Data Mining Process
- Data Mining Challenges
- Tools
  - Weka
  - Tableau

Class 2.Lesson 2
Data Mining Techniques

- Supervised/Predictive Learning
  - You have some idea of what you are looking for
    - Classification
    - Estimation

- Unsupervised/Descriptive Model
  - You leave it to the mining process to find something interesting
    - Association Rules
    - Clustering
    - Profiling

Class 3. Data

- Lesson 1: Data
  - What is Data?
    - Types of Attributes
    - Discrete & Continuous
  - Data Quality
    - Noise; Outliers; Missing Values; Duplicate data
- Lesson 2: Data Preprocessing
  - Aggregation
  - Sampling
  - Dimension Reduction
  - Feature Selection
  - Discretization
- Lesson 3: Weka
  - Algorithms for Data Quality
  - Algorithms for Data Preprocessing

Class 3.Lesson 1
Data

- What is Data?
  - Types of Attributes
  - Discrete & Continuous
- Data Quality
  - Noise; Outliers; Missing Values; Duplicate data

Class 3.Lesson 2
Data preprocessing

- Aggregation
- Sampling
- Dimensionality Reduction
- Feature subset selection/creation
- Discretization

Class 3. Lesson 3
Weka for data quality & preprocessing

- Intro to Weka
  - Explorer
  - Input Data Format
    - ARFF (Attribute Relation File Format)
- Algorithms for Data Quality
  - Noise; Outliers; Missing Values; Duplicate data
- Algorithms for Data Preprocessing
  - Sampling; Dimensionality Reduction; Feature subset selection/creation; Discretization

Class 4: Data Exploration

- Summary Statistics
  - Frequency & Mode
  - Measure of Location
  - Measure of Spread
- Visualization
  - Representation; Arrangement; Selection
  - Histogram; Box Plot; Scatter/Contour Plots
- Online Analytical Processing (OLAP)
  - Data Cube
  - OLAP Operations
    - Slicing/Dicing
    - Roll-up & Drill-down

Class 5. Classification: Basic Concepts & Techniques

Lesson 1. Classification
- Basic Concepts
- Decision Tree
  - Hunt's Algorithm
  - Tree Induction Issues
    - Stopping Criteria
    - Best Split

Lesson 2. Practical Issues of Classification
- Underfitting & Overfitting
- Confusion Matrix
- Cost of classification

Lesson 3. Model Evaluation
- Metrics for Performance Evaluation
- Methods for Performance Evaluation
- Methods for Model Comparison

Weka: J48 (C4.5)

Class 5.Lesson 1
Basic concepts & Decision Tree Classifier

Lesson 1. Classification

- Basic Concepts
- Decision Tree
  - Hunt's Algorithm
  - Tree Induction Issues
    - Stopping Criteria
    - Best Split

Class 5.Lesson 2
Practical Issues of Classification

- Underfitting and Overfitting
- Model Selection
- Overfitting in Decision Tree

Class 5.Lesson 3
Model Evaluation

- Metrics for Performance Evaluation
  - How to evaluate the performance of a model?
- Methods for Performance Evaluation
  - How to obtain reliable estimates?
- Methods for Model Comparison
  - How to compare the relative performance among competing models?

Class 6.
Alternative Classifications

Lessons

1. Rule-Based Classifier
2. Nearest Neighbor Classifiers
3. Bayesian Classifiers
4. Artificial Neural Networks (ANN)
5. Support Vector Machines
6. Ensemble Methods