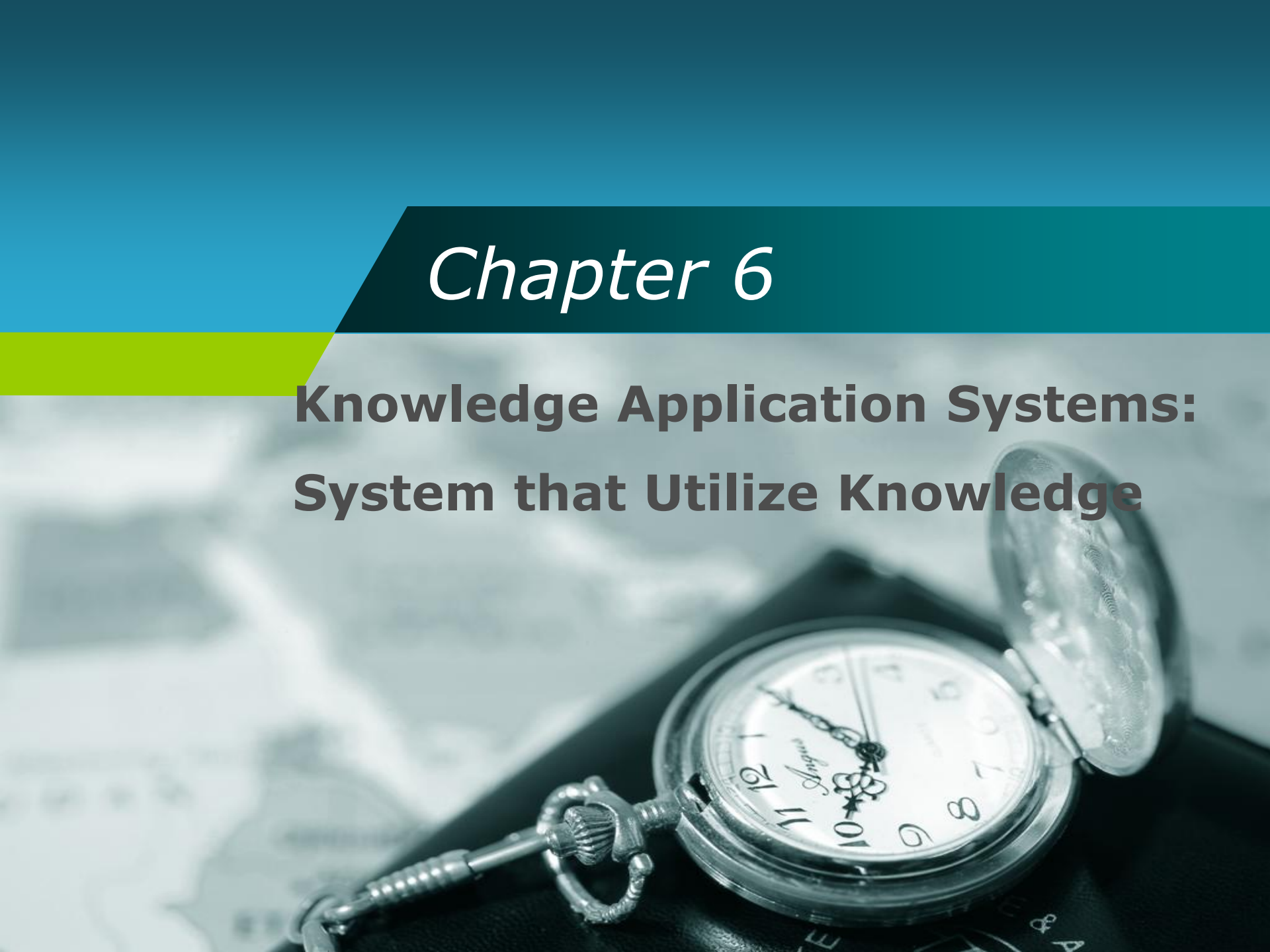
Chapter 6

Knowledge Application Systems: System that Utilize Knowledge



Chapter Objectives

- Describe knowledge application **mechanisms,** which facilitate *direction* and *routines.*
- Explain knowledge application **technologies,** which support direction and routines including:
  - expert systems
  - decision support
  - advisor systems
  - fault diagnosis (or troubleshooting) systems
  - help desk systems.

Directions and Routines

- Hierarchical Relationships
- Help Desks
- Support Center
- Organizational Policies
- Work Practices
- Standards

Which one of those are belong to direction or routine?

Technologies for Knowledge Application Systems

- Artificial Intelligence (AI)
  - Rule-based System
  - Case-based Reasoning (CBR)
  - Constraint-based Reasoning
  - Model-based Reasoning (MBR)
  - Diagrammatic Reasoning

Artificial Intelligence

- Enabling computers to perform tasks that resemble human thinking ability
- The science that provides computers with the ability to represent and manipulate symbols so they can be used to solve problems not easily solved through algorithmic models
- Based on the understanding that intelligence and knowledge (associated with manipulate cognitive symbol) are tightly intertwined
- Related with KM: natural language understanding, classification, etc

Rule-based System

- Applicable when the **domain knowledge can be defined by a manageable set of rules or heuristics**
- The **process of eliciting the knowledge from expert and representing it that is usable by computers (knowledge engineering)**
  - Interviewing in detail the domain expert
  - Representing the knowledge more commonly in a set of heuristics or rules-of-thumb (IF-THEN statement)
- **Disadvantage**: the number of rules that represent the domain may be quite large
  - Difficulty in coding, verifying, validating and maintaining the rules
  - Reduction in the efficiency of the inference engine executing the rules
- Example: SOS Advisor KM application ensures the small medium enterprise is eligible for the funding program

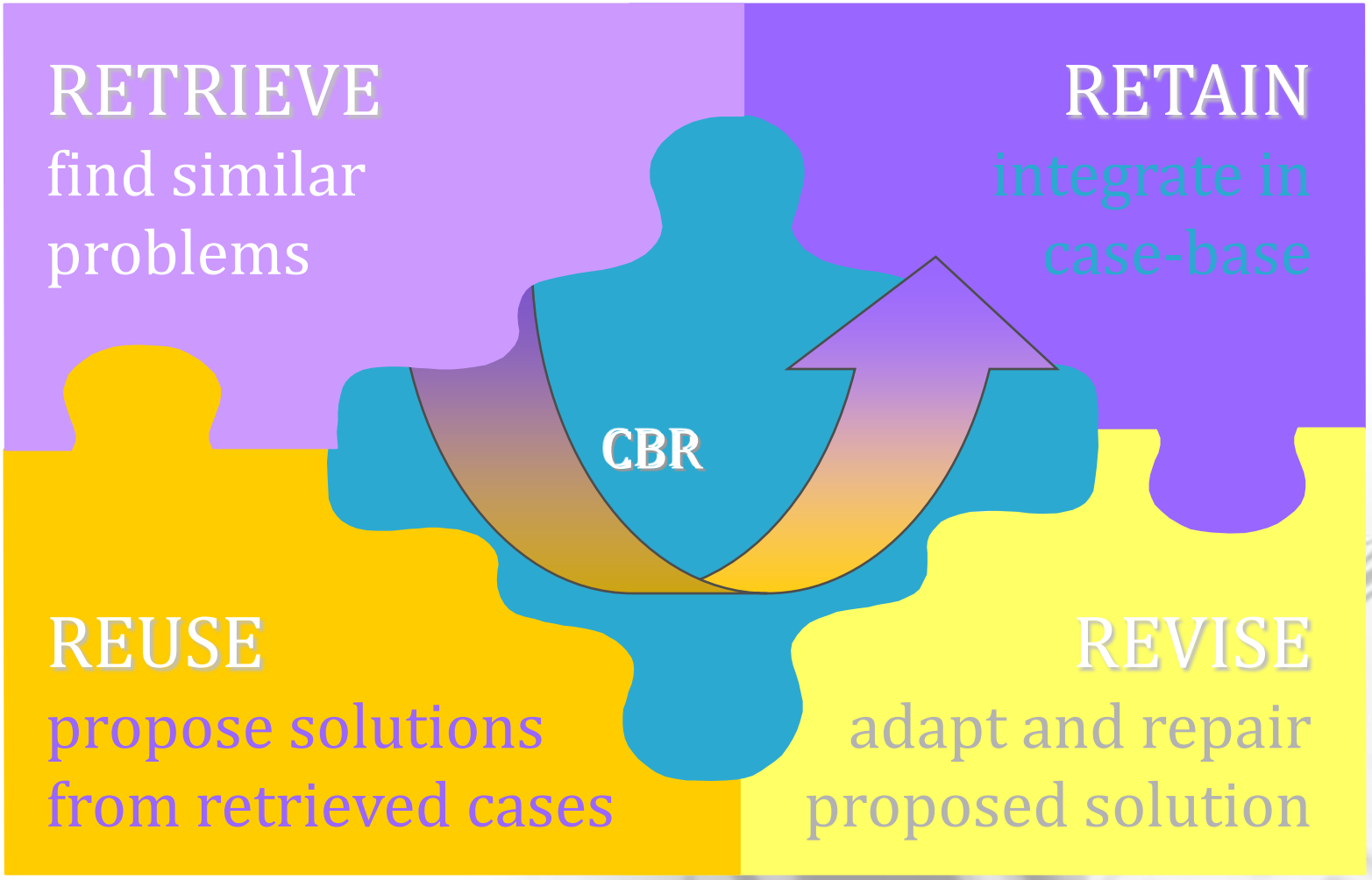
Case-Based Reasoning (CBR)

- A method of analogical reasoning that **utilizes old cases or experiences in an effort to solve problems**, critique solutions, explain anomalous or interpret situations
- The **most popular technique for the implementation of knowledge application system in business**
  - CBR implementations take advantage of explicit knowledge that exist in organization (e.g. problem reports)
- **Applicable**:
  - in weak-theory domains, that is, where an expert either doesn't exist or doesn't fully understand the domain
  - if the experience base spans an entire organization rather than a single individual
- **Consist of the following processes**:
  - Search the case library for similar cases.
  - Select and retrieve the most similar case(s).
  - Adapt the solution for the most similar case.
  - Apply the generated solution and obtain feedback.
  - Add the newly solved problem to the case library.

CBR System Components

- Case-base
  - Database of previous cases (experience)
  - Episodic memory
- Retrieval of relevant cases
  - Index for cases in library
  - Matching most similar case(s)
  - Retrieving the solution(s) from these case(s)
- Adaptation of solution
  - Alter the retrieved solution(s) to reflect differences between new case and retrieved case(s)

CBR System – R^4 cycle



CBR System

Variations of Case-Based Reasoning

- Exemplar-based reasoning: solve problems through classification
- Instance-based reasoning: large number of instances (or cases) which are defined by a small set of attributes vectors.
- Analogy-based reasoning: solve new problems based on past cases from a different domain

Advantage:

- When the relationship between the case attributes and the solution is not understood well enough to represent in rules
- Ratio of cases that are “exceptions to the rule” is high

Constraint-based Systems

- Applicable in domains that are defined by constraints or what cannot be done
  - Planning and scheduling (ex. to schedule a meeting all the individuals that need to attend must be available at the same time, otherwise the “availability constraint” will be violated)
- Based on:
  - *Constraint-based reasoning*
    - problem solving technique that, when given a set of variables and constraints on these variables, can find a set of values that satisfy all the constraints.
  - *Constraint Satisfaction*
    - Constraint systems reflect what constraints restrict possible solutions.

Model-Based Reasoning (MBR)

- An intelligent reasoning technique that uses model of an engineered system to simulate its normal behavior
  - The simulated operation is compared with the behavior of a real system and noted discrepancies can lead to a diagnosis
  - e.g. a hurricane model can be designed and implemented to predict a hurricane trajectory, given the set of current weather conditions (wind speed, etc)
- Applicable when designing a system based on the description of the internal workings of an engineered system (design specifications, drawings and books)

Diagrammatic Reasoning

- Artificial intelligence technique that aims to understand concepts and ideas using diagrams that represent knowledge
- Applicable when the domain is best represented by diagrams and imagery, such as when solving geometric problems

Developing Knowledge Application Systems

Using Case-method Cycle

- Methodology that describes an iterative approach to effectively develop CBR and knowledge application system in general
- Steps:
  - System development process
    - to develop a knowledge application system that will store new cases and retrieve relevant cases.
  - Case library development process
    - to develop and maintain a large-scale case library that will adequately support the domain in question.
  - System operation process
    - to define the installation, deployment, and user support of the knowledge application system

Developing Knowledge Application Systems [2]

- Steps case-method cycle (cont.):
  - Database mining process
    - uses rule inference techniques and statistical analysis to analyze the case library.
  - Management process
    - describes how the project task force will be formed and what organizational support will be provided
  - Knowledge transfer process
    - describes the incentive systems to encourage user acceptance and support.

Developing Knowledge Application Systems [3]

- Sub-processes of developing the case library:
  - Case Collection
  - Attribute-Value Extraction and Hierarchy Formation
    - Seek to create a list of attributes that define each case, a list of values for each attribute and a possible grouping of such attributes, define relationships among the attributes
  - Feedback
- CASE Method in CBR development:
  - significant reduction in system development workload and costs
- Knowledge application systems:
  - apply a solution to a similar problem
  - serve as a framework for *creative reasoning*.

Developing Knowledge Application Systems [4]

- Knowledge application systems enabled the implementation of decision support systems
  - to support design tasks in diverse domains such as architecture, engineering, and lesson planning.
  - *case-based design aids* (CBDA's) help human designers by making available a broad range of commentated designs.
  - Case libraries accumulate organizational experiences, considered corporate memory.

Types of Knowledge Application Systems

- Helpdesk system
- Fault diagnosis or troubleshooting system
- Expert system
- Advisor system
- Decision-support system

Group Discussion

- Create a group consists of 1-3 students
- Read case studies on page 101-119 in Becerra Books
- Answer following questions:
  - Explain the type of each technology and knowledge application systems
  - What is the goal of each application?
  - How those applications could be used?
  - How is the architecture of each application?
- Submit your answer in word document and upload it to Scele
- Deadline: 23 March 2017 at each class schedules

References

- Irma Becerra-Fernandez and Rajiv Sabherwal (2010). Knowledge Management Systems and Processes. M.E. Sharpe, Inc. ISBN: 978-0-7656-2351-5
- Elias M. Awad, Hassan M. Ghaziri (2004). Knowledge Management. Prentice Hall. ISBN: 0-13-034820-1.
- Madanmohan Rao (2004). Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions. Butterworth-Heinemann. ISBN: 0750678186.
- Amrit Tiwana (2002). The Knowledge Management Toolkit: Orchestrating IT, Strategy, and Knowledge Platforms (2nd Edition). Prentice Hall. ISBN: 013009224X