Sistem Pakar

M. Ali Fauzi

Expert System

M. Ali Fauzi

TODAY

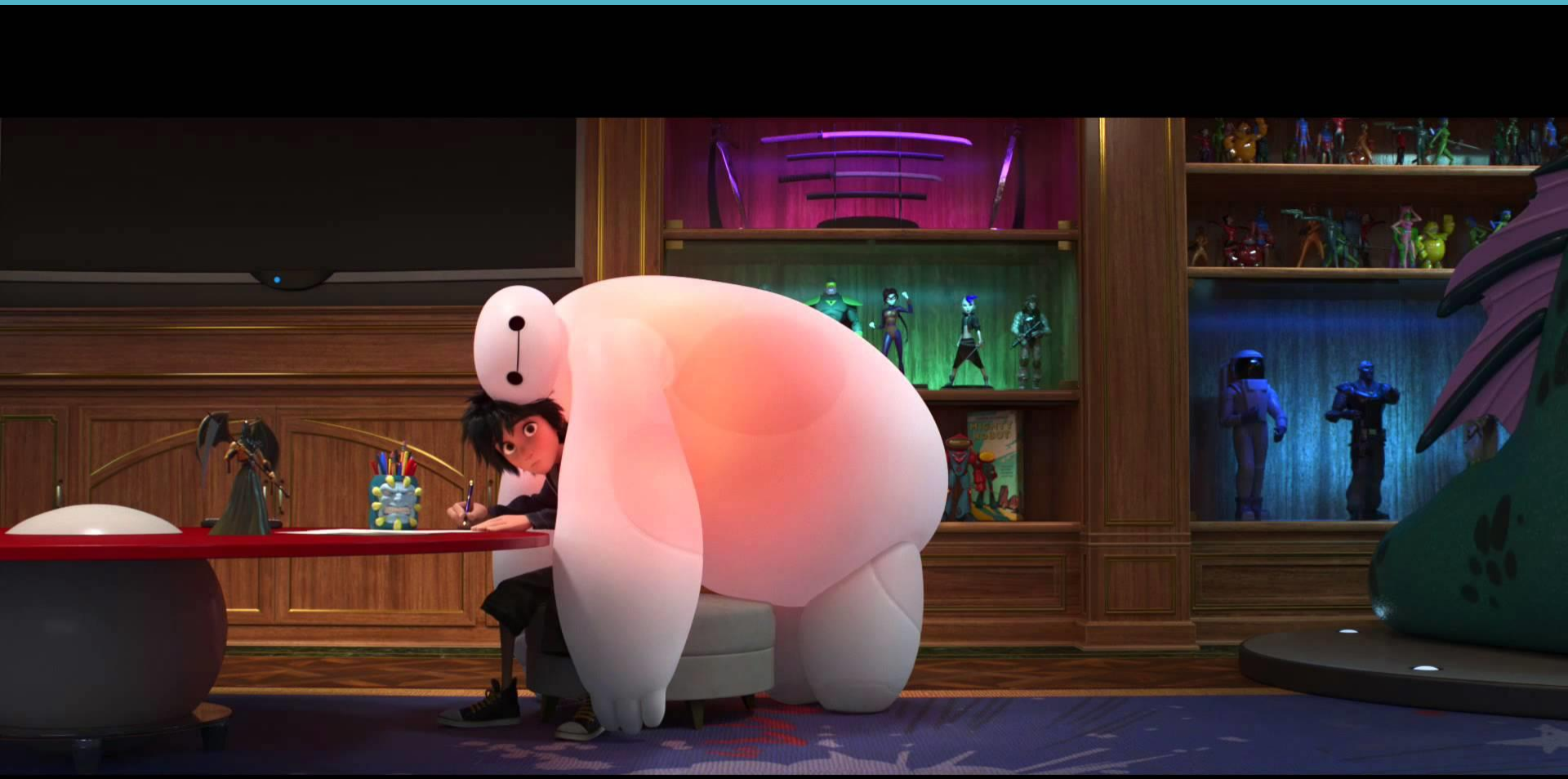
~ What is expert system?

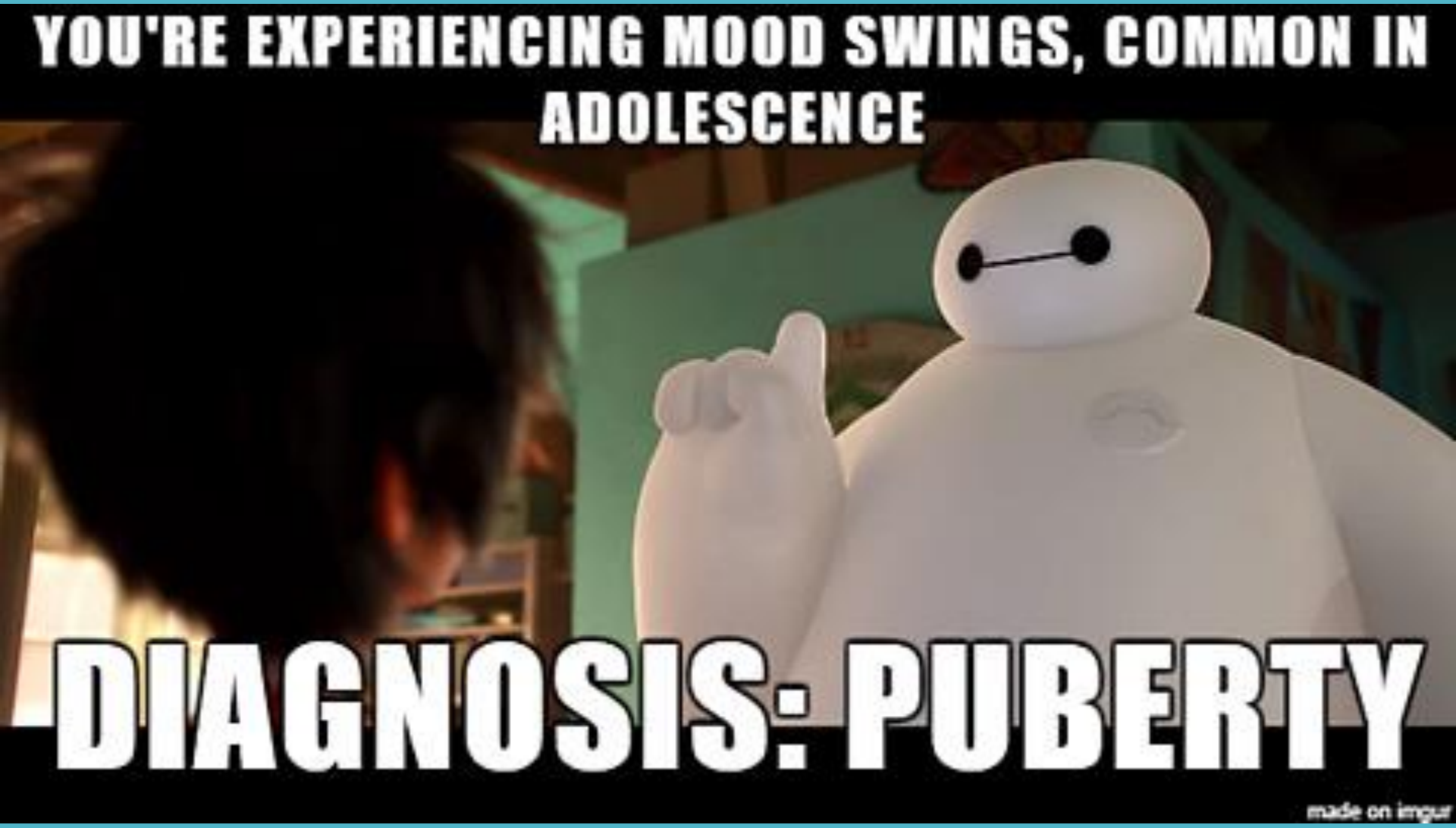
~ What is expert system?

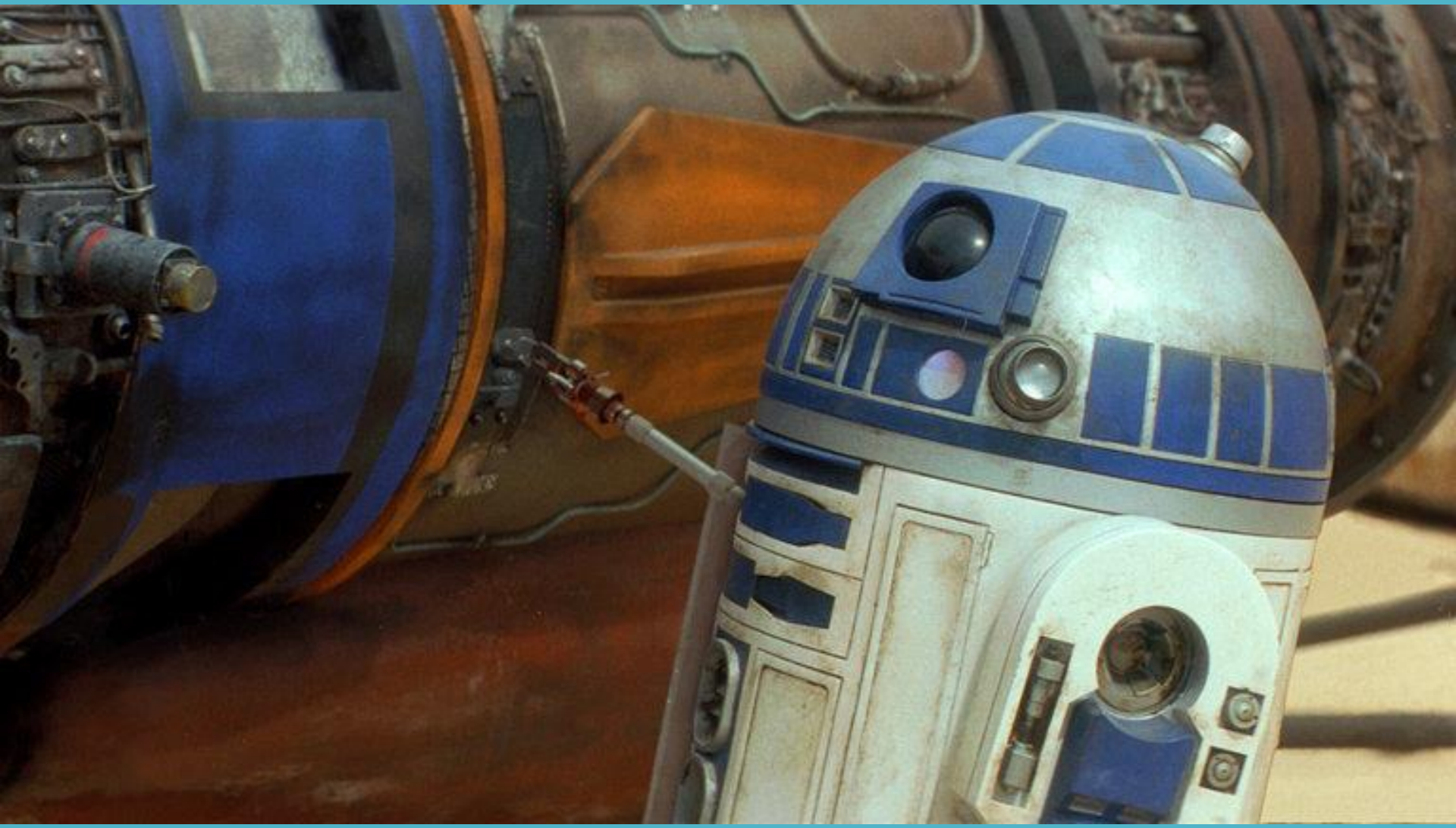
~ What can expert system do?

~ What is expert system?
~ What can expert system do?
~ What is this course?

Sci-Fi AI – Expert System




YOU'RE EXPERIENCING MOOD SWINGS, COMMON IN ADOLESCENCE
DIAGNOSIS: PUBERTY
made on imgur



What is Expert System?

"A computer system which emulates the decision-making ability of a human expert"

"A computer system capable of giving advice in a particular domain"

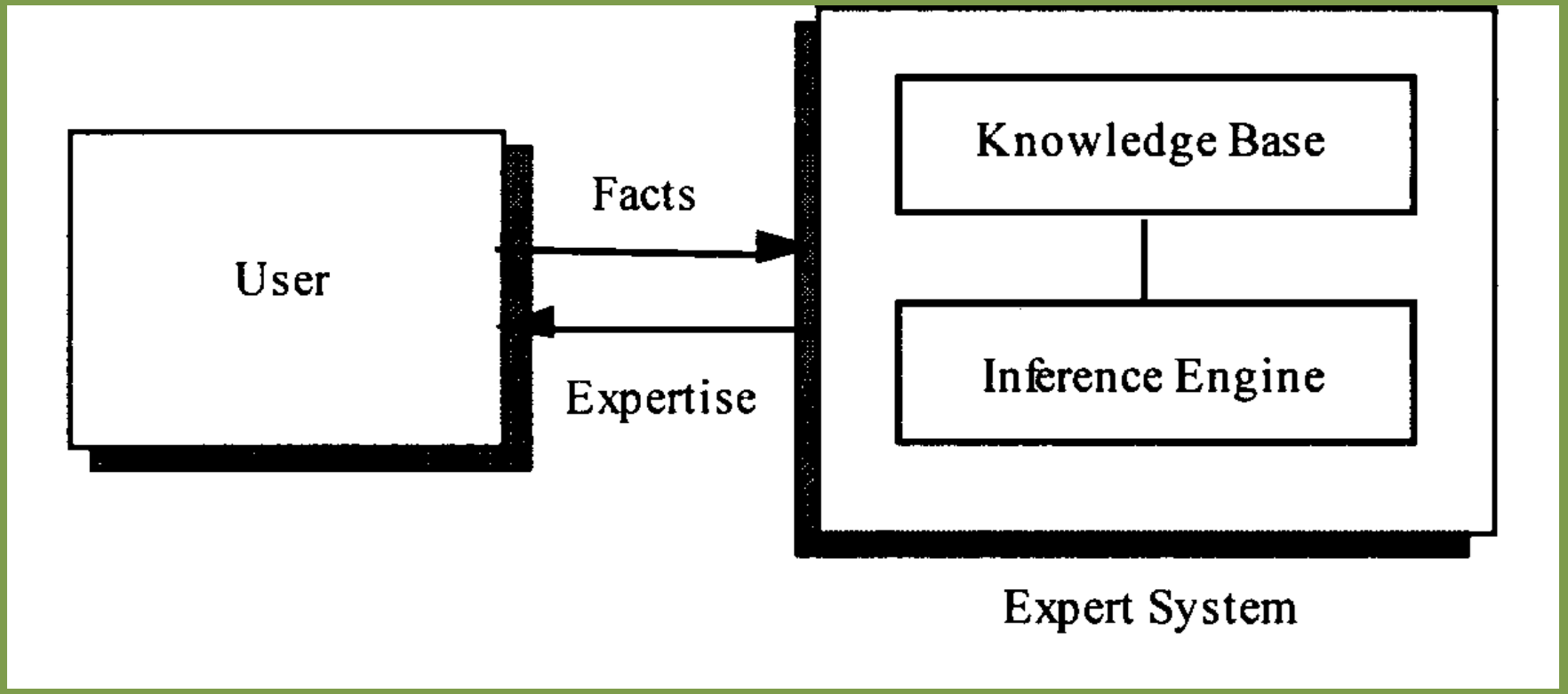
"A model of the expertise of the best practitioners of the field"

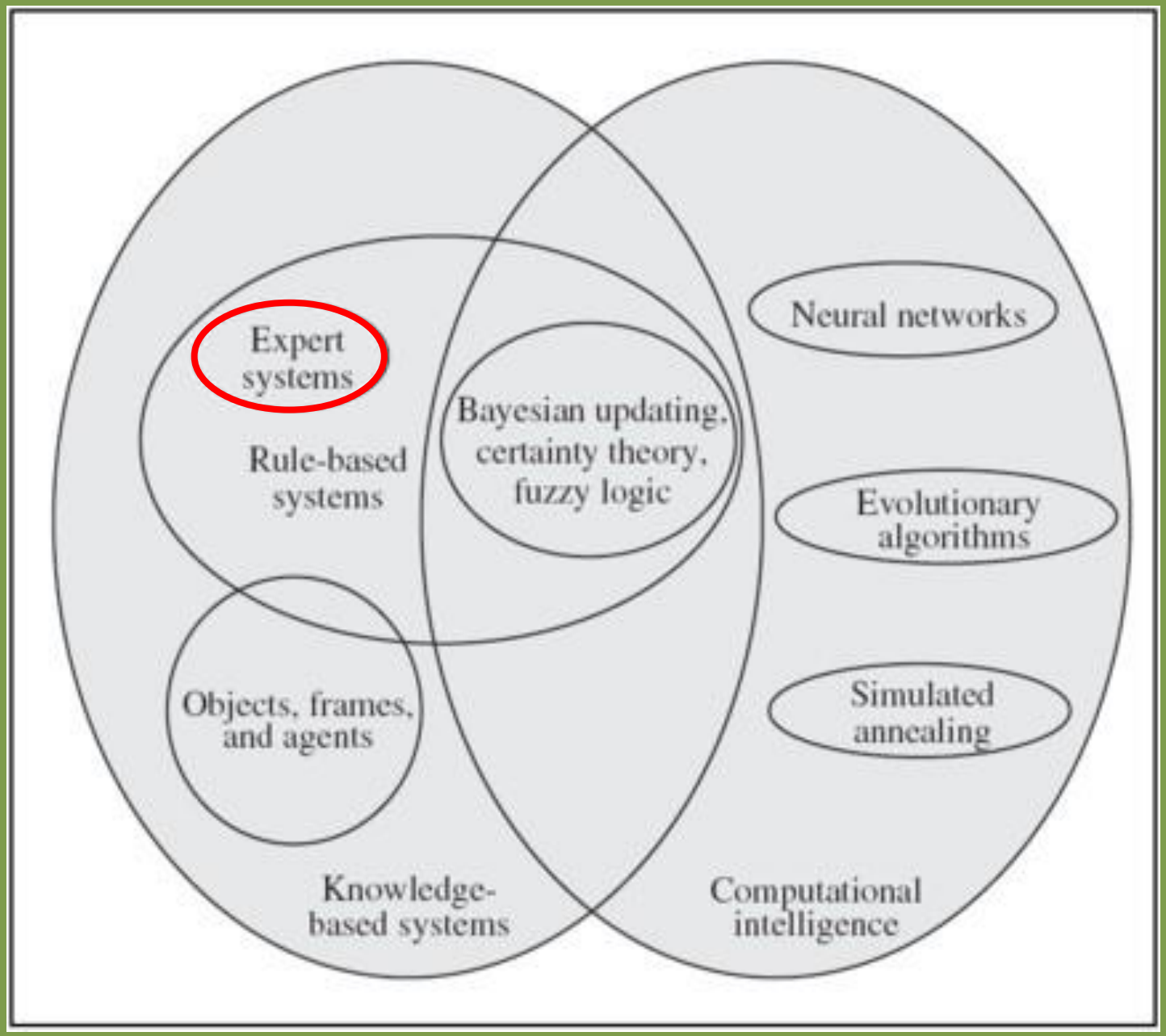
“An expert system is a system that employs human knowledge captured in a computer to solve problems that ordinarily require human expertise”
~ Turban

“A computer program that emulates the behaviour of human experts who are solving real-world problems associated with a particular domain of knowledge.”
~ Pigford & Braur

"An automated reasoning system that attempts to mimic the performance of the human expert."
~ Rosenman

Expert System =
Knowledge Base +
Inference Engine


User
Facts
Expertise
Knowledge Base
Inference Engine
Expert System


Expert systems
Rule-based systems
Bayesian updating, certainty theory, fuzzy logic
Objects, frames, and agents
Knowledge-based systems
Neural networks
Evolutionary algorithms
Simulated annealing
Computational intelligence

Advantages

~ Capture of scarce expertise

~ Are Reliable. The ability of an expert could be not consistent

~ Sometimes there are some human errors, or the data may be less accurate

~ Some experts may have different opinions

Advantages

~ Documenting and Promoting knowledge of experts

~ Efficient:

- Less time
- Less costs
- Long Life time

~ Minimize unnecessary losses

Disadvantages

~ The cost of system development and maintenance is quite (relatively) expensive

~ Expertise hard to extract from experts

~ Knowledge not always readily available

~ Totally dependent on their knowledge base

Disadvantages

~ Expert systems can't achieve 100% accuracy because of changes and developments in knowledge

~ Can't adapt new situations creatively like people can

~ Don't recognize when no answer exists or when the problem is outside their field

A (Short) History of Expert Systems

1. *Early to Mid-1960s*

~ One attempt: the General-purpose Problem Solver (GPS)

~ General-purpose Problem Solver (GPS)

~ A procedure developed by Newell and Simon [1973] from their Logic Theory Machine -

- ~ Attempted to create an "intelligent" computer
- ~ Predecessor to ES
- ~ Not successful, but a good start

2. Mid-1960s: Special-purpose ES programs

DENDRAL & MYCIN

~ **Researchers recognized that the problem-solving mechanism is only a small part of a complete, intelligent computer system**

- **General problem solvers *cannot* be used to build high performance ES**
- **Human problem solvers are good only if they operate in a very *narrow domain***
- **Expert systems must be constantly *updated* with new information**
- **The complexity of problems requires a considerable amount of *knowledge about the problem area***

3. *Mid 1970s*

~ Several Real Expert Systems Emerge

~ Recognition of the Central Role of Knowledge

~ AI Scientists Develop

- Comprehensive knowledge representation theories

- General-purpose, decision-making procedures and inferences

~ Limited Success Because

- Knowledge is Too Broad and Diverse

- Efforts to Solve Fairly General Knowledge-Based Problems were Premature

BUT

Several knowledge representations worked

Key Insight

"The power of an ES is derived from the specific knowledge it possesses, not from the particular formalisms and inference schemes it employs"

4. Early 1980s

ES Technology Starts to go Commercial

- *XCON*
- *XSEL*
- *CATS-1*

Programming Tools and Shells Appear

- *EMYCIN*
- *EXPERT*
- *META-DENDRAL*
- *EURISKO*

About 1/3 of These Systems Are Very Successful and Are Still in Use

Latest ES Developments

~ Many tools to expedite the construction of ES at a reduced cost

~ Dissemination of ES in thousands of organizations

~ Extensive integration of ES with other CBIS

~ Increased use of expert systems in many tasks

~ Use of ES technology to expedite IS construction

Latest ES Developments

~ The object-oriented programming approach in knowledge representation

~ Complex systems with multiple knowledge sources, multiple lines of reasoning, and fuzzy information

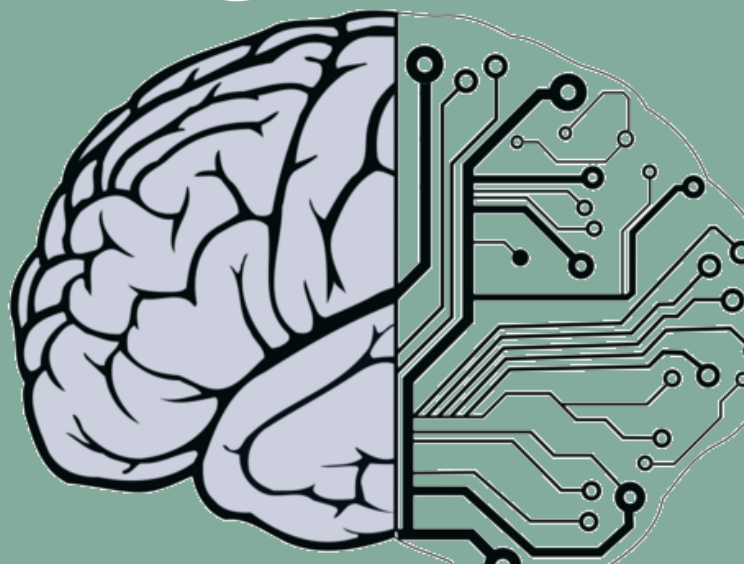
~ Use of multiple knowledge bases

~ Improvements in knowledge acquisition

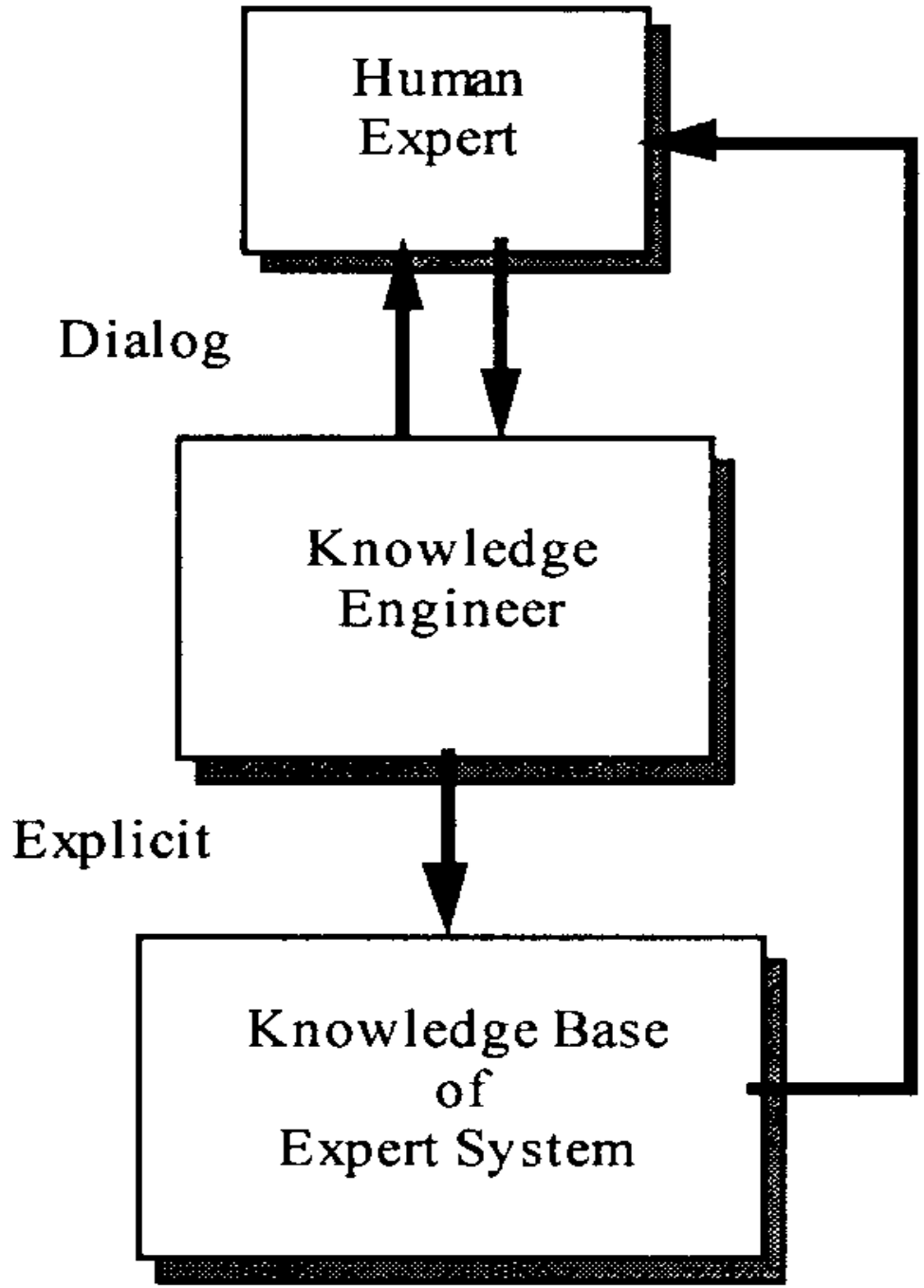
~ Larger storage and faster processing computers

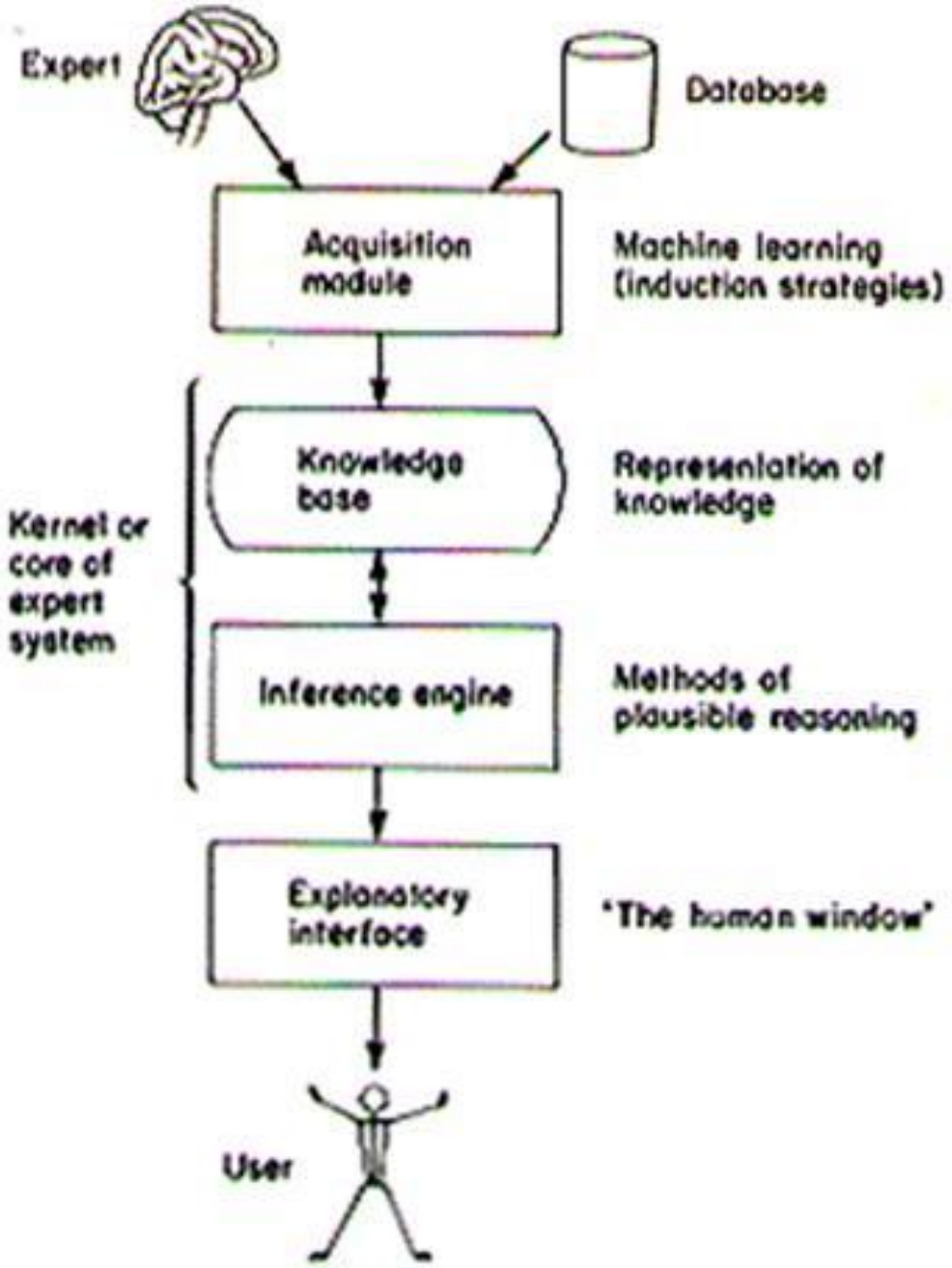
~ The Internet to disseminate software and expertise.

Basic Concepts of Expert Systems



~ Expertise
~ Experts
~ Transferring Expertise
~ Inferencing Rules
~ Explanation Capability


Human
Expert
Dialog
Knowledge
Engineer
Explicit
Knowledge Base
of
Expert System

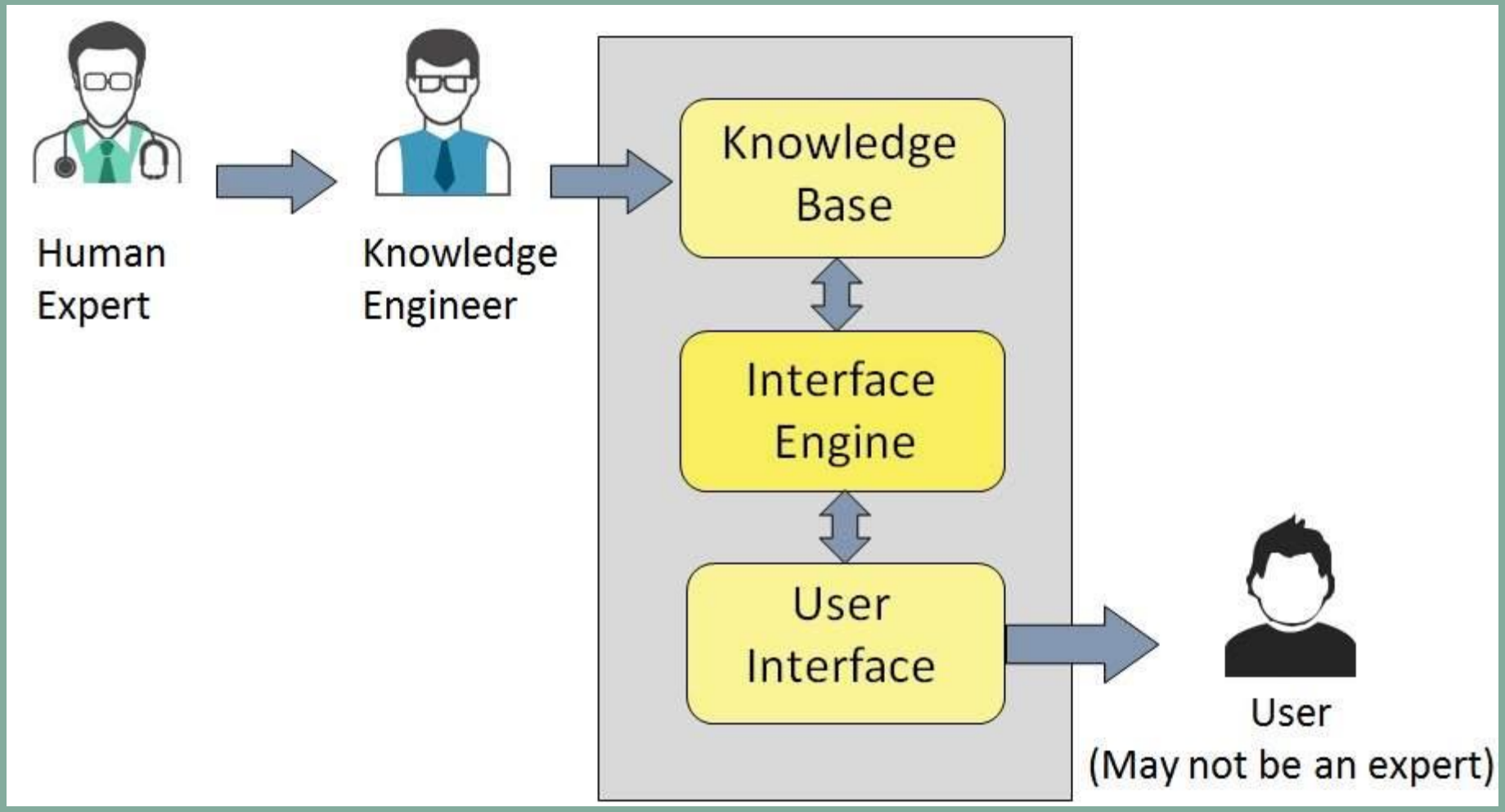

Expert
Database
Acquisition module
Machine learning (induction strategies)
Knowledge base
Represenlation of knowledge
Kernel or core of expert system
Inference engine
Methods of plausible reasoning
Explanatory interface
'The human window'
User

Three Major ES Components

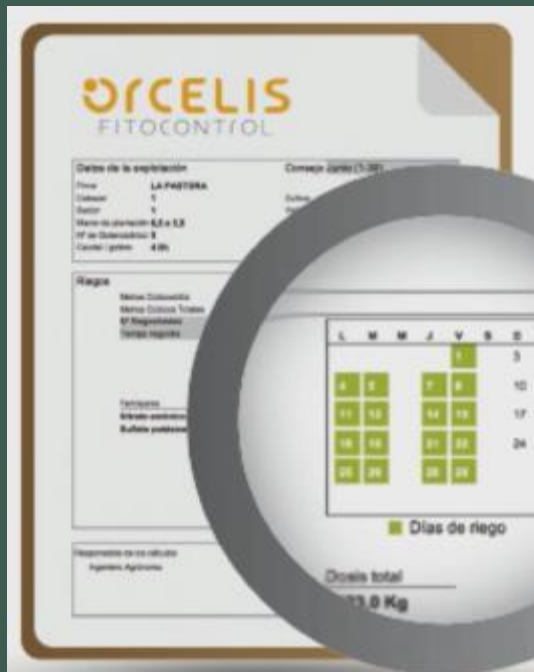
~ Knowledge Base

~ Inference Engine

~ User Interface


Human Expert
Knowledge Engineer
Knowledge Base
Interface Engine
User Interface
User
(May not be an expert)

What Can Expert System Do?



Category	Problem Addressed	Examples
Interpretation	Inferring situation descriptions from sensor data	Hearsay (Speech Recognition), PROSPECTOR
Prediction	Inferring likely consequences of given situations	Preterm Birth Risk Assessment[34]
Diagnosis	Inferring system malfunctions from observables	CADUCEUS, MYCIN, PUFF, Mistral,[35] Eydenet,[36] Kaleidos[37]
Design	Configuring objects under constraints	Dendral, Mortgage Loan Advisor, R1 (DEC VAX Configuration)
Planning	Designing actions	Mission Planning for Autonomous Underwater Vehicle[38]
Monitoring	Comparing observations to plan vulnerabilities	REACTOR[39]

Category	Problem Addressed	Examples
Debugging	Providing incremental solutions for complex problems	SAINT, MATHLAB, MACSYMA
Repair	Executing a plan to administer a prescribed remedy	Toxic Spill Crisis Management
Instruction	Diagnosing, assessing, and repairing student behavior	SMH.PAL,[40] Intelligent Clinical Training,[41] STEAMER[42]
Control	Interpreting, predicting, repairing, and monitoring system behaviors	Real Time Process Control,[43] Space Shuttle Mission Control[44]

EXAMPLES OF ES IN MEDICAL

(1) **PXDES**

- ✓ It is example of medical expert system.
- ✓ It is a lung disease, X-ray diagnosis.
- ✓ It takes our lungs picture from upper side of body which looks like a shadow.
- ✓ The shadow is used to determine the type and degree of harmness.

EXAMPLES OF ES IN MEDICAL

(2) **CaDet**

- ✓ It is for early cancer detection.
- ✓ Clinical data related to early cancer detection and to cancer risk factors was collected and incorporated in database, together with heuristic rules for evaluating this data.

EXAMPLES OF ES IN MEDICAL

(3) DXplain

✓ It is used for diagnosis.

✓ Its data based contain approximately 4,500 suggestion for over 2,000 different diseases.

EXAMPLES OF ES IN MEDICAL

(4) **MYCIN**

- ✓ It is simple example of ES.
- ✓ It performs a task normally done by a human expert.
- ✓ It attempts to recommend appropriate therapies for patient with bacterial infections.
- ✓ It uses internally rules. to reason backward to the clinical data available from its goal of finding disease-causing organism.

EXAMPLES OF ES IN MEDICAL

(5) GERMWATCHER

✓ It is for infection control.

EXAMPLES OF ES IN MEDICAL

(5) GERMWATCHER

✓ It is for infection control.

EXAMPLES OF ES IN MEDICAL

(6) **NHS**

✓ **NHS Choices (www.nhs.uk) is the official website of the National Health Service in England.**

General assessment

Please select the general area of concern

Some symptoms are covered by more than one health and symptom checker, so please select the option which is the closest match to your symptoms or enquiry:

- *Rashes* or skin problems [Help]
- Male or female sexual or genital health or contraception advice [Help]
- Pregnancy problems [Help]
- Mental health or confusion [Help]
- Accident, wound or injury [Help]
- Bones, muscles, aches and pains [Help]
- Stomach, bowel and *bladder* [Help]
- Children's health [Help]
- Head and neck [Help]
- Ear, nose and throat [Help]
- General health [Help]
- Diabetes
- Sleep disturbances, low mood or behaviour change

Previous Next

Previous answers

1. **What do you need help with?**
   You have symptoms that are concerning you

EXAMPLES OF ES IN AGRICULTURE

(1) RICE-CROP DOCTOR

- ✓ This ES is developed by NATIONAL INSTITUTE OF AGRICULTURAL EXTENSION MANAGEMENT.
- ✓ Its main work is to diagnose pests and diseases for rice crop and suggest preventive measures.
- ✓ It has knowledge about diseases and pests for identification and suggesting preventive measures.

Rice Knowledge Bank
Your information source for rice farming

-Select your country-

search for...

HOME | STEP-BY-STEP PRODUCTION | AGRONOMY GUIDES | DECISION TOOLS | TRAINING

Home > Decision tools > Rice Doctor

Rice Doctor

Print Save

Welcome to the Rice Doctor. This diagnostics tool will help you to identify problems in your crop and provide actionable advice how to manage them.

Diagnostic tool

Start diagnosis »

Fact sheets

View list »

Rice Doctor for Android mobile devices.
Download in Google Play »

Rice Doctor for Apple mobile devices.
Download in Apple store » »

Feedback

EXAMPLES OF ES IN AGRICULTURE

(2) **AGREX**

- ✓ It gives correct advice to farmers.
- ✓ Topics of advice are fertilizer application, crop protection, irrigation scheduling and diagnosis of diseases in paddy and post harvest technology of fruits and vegetables

EXAMPLES OF ES IN AGRICULTURE

(3) **E-Crop**

- ✓ **E-Crop Doctor is an application software developed by CEL for the farmers and other agri-stakeholders in Kerala,**
- ✓ **Easy identification of pests, diseases of crops and their preventive measures.**

CENTRE FOR E-LEARNING

KERALA AGRICULTURAL UNIVERSITY

KAU E-CROP DOCTOR

A plant protection advisor for the crops of Kerala

EXAMPLES OF ES IN AGRICULTURE

(4) ORCELIS
✓ A Complete agricultural ES

3 Orcelis Fitocontrol has the answer

- Watering timing
- Amount of fertilizers
- Special treatments
- and much more...

EXAMPLES OF ES IN EDUCATION

(1) The M-Star School Expert System

✓ The modules and functionality packaged together with the M-Star platform address the needs of the primary and secondary education domain.


Transport
Library
Computer Lab
School Stores
Principal's Office
Server Room
Manager
Faculty Lounge
Classroom
Administrative Offices
TRC
Admissions
School