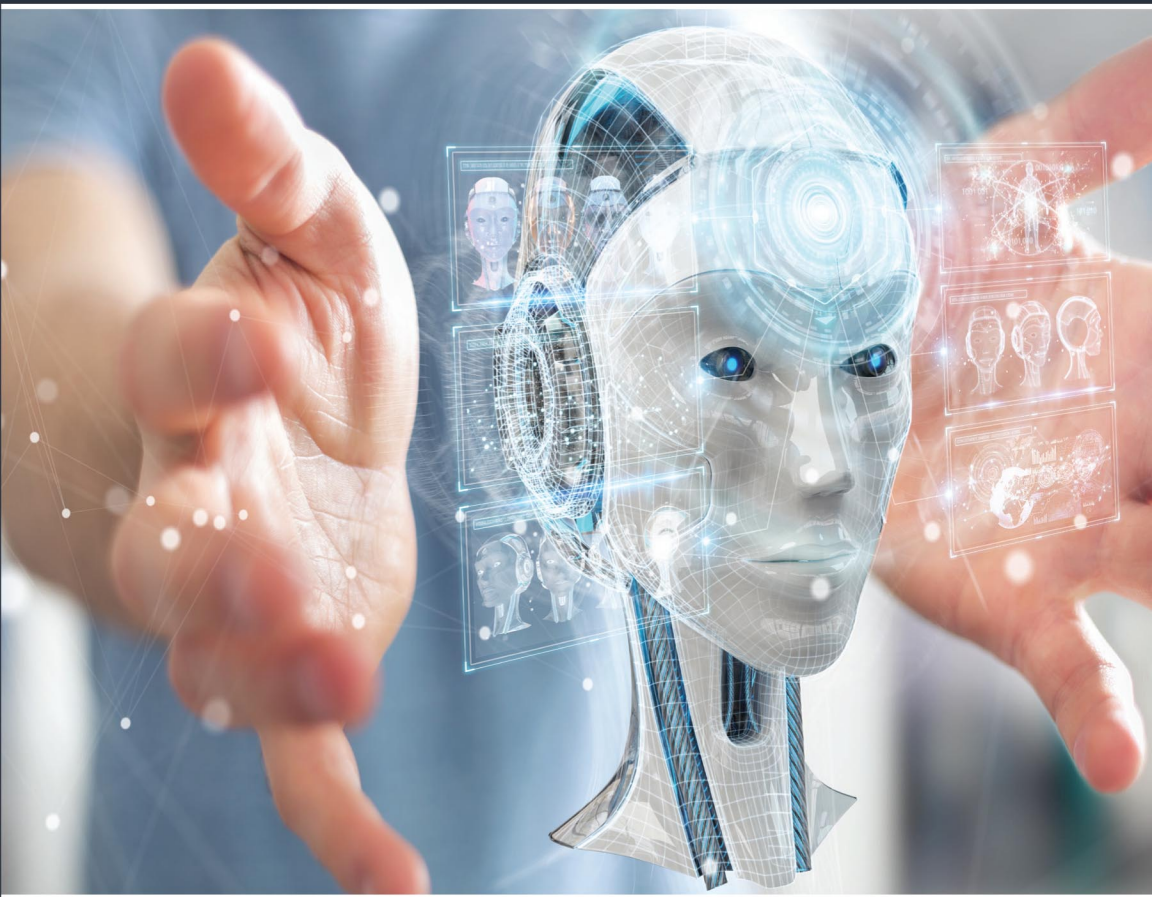


Key Concepts in Artificial Intelligence



Jocelyn O. Padallan

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LIST OF ABBREVIATIONS

ABS	Assumption Based System
AI	Artificial Intelligence
AIC	Akaike Information Criteria
AID	Automatic Interaction Detection
ALVINN	Autonomous Land Vehicle in a Neural Net
ANN	Artificial Neural Network
APACHE	Active Physiology and Chronic Health Evaluation
APR	Apple Print Recognizer
ART	Adaptive Resonance Theory
ART	Advanced Reasoning Tool
ATR	Automatic Target Recognition
AVAS	Additivity and Variance Stabilization
BAM	Bidirectional Associative Memory
BIC	Bayesian Information Criteria
BN	Bayesian Network
BNIF	Bayesian Network Interchange Format
BPM	Business Process Modeling
CAD	Coronary Artery Disease
CAI	Computer-Aided Instruction
CART	Classification and Regression Trees
CBR	Case-Based Reasoning
CBT	Case-Based Thinking
CDM	Critical Decision Method
CHAMP	Churn Analysis, Modeling, and Prediction
CKML	Conceptual Knowledge Markup Language
CLIPS	C Language Integrated Production System

CNF	Conjunctive Normal Form
CNN	Complexity Neural Networks
CTA	Cognitive task analysis
DAG	Directed Acyclic Graph
DMQL	Data Mining Query Language
DNF	Disjunctive Normal Form
EA	Evolutionary Algorithm
EDR	Electronic Dictionary Research
EM	Expectation-Maximization
EP	Evolutionary Programming
ETPS	Educational Theorem Proving System
FAM	Fuzzy Associative Memory
FCM	Fuzzy Cognitive Map
FIFO	First-In, First-Out
FPGA	Field-Programmable Gate Array
FRA	Fuzzy Rule Approximation
FRL	Frame Representation Language
GA	Genetic Algorithm
GAMs	Generalized Additive Models
GLD	Generalized Logic Diagram
GPS	General Problem Solving
GPTs	General-Purpose Technologies
GRNN	General Regression Neural Network
HME	Hierarchical Mixtures of Experts
HMM	Hidden Markov Model
HPC	High-Performance Computing
HTML	HyperText Markup Language
ICAI	Intelligent Computer-Aided Instruction
ICR	Image Character Recognition
IDB	Intensional DataBase
IES	Intelligent Enterprise Strategy
ILP	Inductive Logic Programming
IoT	Internet of Things
IOU	Intersection Over Union

KDD	Knowledge Discovery in Databases
KDDMS	Knowledge and Data Discovery Management Systems
KDT	Knowledge Discovery in Text
KIF	Knowledge Interchange Format
KQML	Knowledge Query and Manipulation Language
KRL	Knowledge Representation Language
LAD	Least Absolute Deviations
LDA	Linear Discriminant Analysis
LGG	Least General Generalization
LVQ	Learning Vector Quantization
MAP	Maximum a Posteriori
MAPS	Modular Automated Parking System
MARS	Multivariate Adaptive Regression Spline
MBR	Model-Based Reasoning
MCMC	Markov Chain Monte Carlo
Mddb	Multi-Dimensional DataBase
MDLP	Minimum Description Length Principle
MDP	Markov Decision Problem
ME	Mixture-of-Experts
MGCI	Most General Common Instance
MGU	Most General Unifier
MIMD	Multiple Instruction Multiple Datastream
MITA	Metropolitan Life Intelligent Text Analyzer
MLP	Multiple Layer Perceptron
MML	Minimum Message Length
MSE	Mean Square Error
NIL	New Implementation of Lisp
NLP	Natural Language Processing
NLPCA	NonLinear Principal Components Analysis
NNF	Negation Normal Form
NPPC	Nuclear Power Plant Consultant
NRBF	Normalized Radial Basis Function
OCR	Optical Character Recognition
OLAP	Online Analytical Processing

OLS	Ordinary Least Squares
OML	Ontology Markup Language
PAC	Probably Approximately Correct
PBD	Programming by Demonstration
PCFG	Probabilistic Context Free Grammar
PESKI	Probabilities Expert Systems Knowledge and Inference
PIERS	Pathology Expert Interpretative Reporting System
PLS	Partial Least Squares
PNN	Probabilistic Neural Networks
POS	Part-of-Speech
RAD	Rapid Application Development
RALPH	Rapidly Adapting Lateral Position Handler
RBF	Radial Basis function
RBM	Restricted Boltzmann Machines
RDR	Ripple Down Rules
RNN	Recurrent Neural Network
ROLAP	Relational OnLine Analytic Processing
RPA	Robotic Process Automation
RTN	Recursive Transition Network
RTOS	Real Time Operation System
SHOE	Simple HTML Ontology Extension
SIC	Schwartz Information Criteria
SIMD	Single Instruction Multiple Datastream
SME	Subject-Matter Expert
SOM	Self-Organizing Map
SQL	Structured Query Language
SVMs	Support Vector Machines
SVR	Support Vector Regression
TOVE	Toronto Virtual Enterprise
TPS	Theorem Proving System
UMLS	Unified Medical Language System
VRML	Virtual Reality Modeling Language
WER	Word Error Rate

WNG	Word N-Gram
WTM	Word-Tag Model
WWW	World Wide Web
XML	eXtended Markup Language

PREFACE

Artificial intelligence (AI) refers to the ability of a digital computer or, in other words, of the computer-regulated robot to carry out the tasks mainly associated with intellectual beings. This term, most of the time, is implemented to the project of systems that are developing furnished with the intellectual processes attributes of human beings, for instance, the ability of being rational or logical, or to discover purpose, observe, or learn from the experiences in the past.

Since the 1940s, during the evolution of the digital computer, it has been identified that computers can be programmed to perform very complex duties—as, for instance, demonstrating proofs for mathematical theorems or it can be responsible for playing chess—with immense efficiency. Still, in spite of continuing progress in the speed of computer processing and the capacity of memory to hold things, there are as yet no programs that can be compared to the human elasticity over extensive domains or in roles and functions requiring much day-to-day knowledge.

Conversely, some programs have acquired the operational levels of human experts and professionals in carrying out certain specific functions and duties, in such a manner that artificial intelligence in this restricted sense is established in applications as varied as the medical diagnosis, computer search engines, in addition to the voice or the recognition of handwriting.

The ideal attribute of artificial intelligence is its capacity to account for and be rational as well as take actions that have the best opportunity of obtaining a particular goal. A parameter of artificial intelligence includes machine learning, which basically mentions the concept that computer programs can be activated on their own without any deliberation, learn from and modify themselves with respect to the new data without the requirement of human hands. Deep learning methods authorize this automatic learning by means of the absorption of large amounts of unorganized data, for example, text, images, or video.

The groundwork of artificial intelligence is the principle that human intelligence can be regarded in a manner that a machine can mimic it and execute its functions without any troubles, from the easiest to those that are full of complexity. The objectives of artificial intelligence incorporate imitating human cognitive tasks.

Researchers and developers in this dimension are making astonishingly rapid paces in mimicking tasks and functions such as learning, reasoning, and insights, to the area that these can be concretely elaborated. Some often believe that innovators may shortly be able to establish systems that increase the ability of humans to learn or be logical out on

any subject. While others remain skeptical due to all cognitive functions is tied up with value judgments that are a substance to human experience.

As technology is pacing fast, former benchmarks that viewed and given several definitions to artificial intelligence has become old-fashioned. For instance, machines that evaluate basic activities or identify text by means of optical character recognition are in recent times not considered to personify artificial intelligence, since this role is now taken for granted, in the form of an intrinsic computer function.

This book will introduce the readers to the field of artificial intelligence and its fundamentals. It is precisely designed for readers or students with no prior experience related to AI and its application, and touches upon a diversity of fundamental topics. By the end of the book, readers will understand the basic knowledge of artificial intelligence and the key concepts involved.

A

Aalborg Architecture

The Aalborg architecture provides a method for computing marginal in a join tree representation of a belief net. It handles new data in a quick, flexible manner and is considered the architecture of choice for calculating marginal of factored probability distributions. It does not, however, allow for retraction of data as it stores only the current results, rather than all the data.

Abduction

It was first suggested and initiated by Charles Peirce in the 1870s. The main motive of this is to quantify the patterns and also to suggest plausible hypotheses for a set of observations. This abduction is a form of non-monotone logic.

ABEL

It is a language of modeling which supports the assumptions which are based on reasoning. It is recently implemented in Macintosh Common LISP and is also available on the world wide web (www).

ABS

It is an acronym for a system which is based on assumption, a logic system which uses assumption-based reasoning.

ABSTRIPS

It is derived from the STRIPS program; this is also designed to solve the robotic placement and the movement problems. Not like the STRIPS it also offers the difference between the current and the goal which state by working from the most critical to the least critical difference.

Accuracy

Accuracy is a machine which is a learning system and it measures the percentage of the correct predictions or the classifications which is made by the model over a specific data set. The proportion of incorrect predictions on the same data is called the complement or error rate.

ACE

It is a technique which is based on regression that estimates additive models for smoothed response attributes. The transformation has been found out very useful in understanding the nature of the problem at hand, as well as providing predictions.

ACORN

It is a Hybrid rule-based on the Bayesian system basically for advising the management of chest pain patients who are in the emergency room. It was developed and used in the mid-1980s.

Action-based Planning



Figure 1. Goal Setting and action planning.

Source: *Image by Captterra Blog.*

It is the goal of action-based planning which is to determine how to decompose a high-level action into a network of sub actions that perform the requisite task. Therefore, the major task within such a planning system is to manage the constraints that apply to the interrelationships (e.g., ordering constraints) between actions. In fact, action-based planning is best viewed as a constraint satisfaction problem.

The search for a plan cycles through the following steps: choose a constraint and apply the constraint check; if the constraint is not satisfied, choose a bug from the set of constraint bugs; choose and apply a fix, yielding a new plan and possibly a new set of constraints to check. In contrast, state-based planners generally conduct their search for a plan by reasoning about how the actions within a plan affect the state of the world and how the state of the world affects the applicability of actions.

Activation Functions

It has the Neural networks which obtains so much of their power through the use of activation functions instead of the linear functions of classical regression models. Basically, the inputs to a node in a neural network which are weighted and then summed. This sum is then passed through a non-linear activation function. Usually, these functions are sigmoidal (monotone increasing) functions such as a logistic or Gaussian function, although output nodes should have activation functions matched to the distribution of the output variables. Activation functions are closely related to the link functions in statistical generalized linear models and have been intensively studied in that context.

Active Learning

A proposed technique for adjusting machine learning algorithm by permitting them to determine test areas to work on their accuracy. Anytime, the calculation can pick another point x , notice the output and join the new (x, y) pair into its training base. It has been applied to neural networks, prediction functions, and clustering functions.

Act-R

A goal-oriented cognitive architecture, Act-R is coordinated around a single objective stack. Its memory contains both declarative memory components and procedural memory that contains production rules. The declarative memory components have both activation esteems and associative qualities with other components.

Active Physiology and Chronic Health Evaluation (APACHE III)

APACHE is a framework intended to anticipate a person's chances of passing away in a hospital. The framework depends on a large assortment of case information and uses 27 credits to anticipate a patient's result. It can likewise be utilized to assess the impact of a proposed or real treatment plan.

ADABOOST

It is an as of late created strategy for further developing AI strategies. It can drastically work on the exhibition of classification methods (e.g., decision trees). It works by over and over applying the strategy to the information,

assessing the outcomes, and afterward reweighting the perceptions to give more prominent credit to the cases that were misclassified. The last classifier utilizes the entirety of the middle of the road classifiers to characterize a perception by a greater part vote of the individual classifiers. It additionally has the intriguing property that the speculation mistake (i.e., the blunder in a test set) can keep on diminishing even after the blunder in the preparation set has quit diminishing or arrived at 0. The procedure is as yet under active development and investigation (starting at 1998).

Adaptive Interface

A PC interface that consequently and progressively adjusts to the necessities and competence of every individual client of the product. The benefits of an adaptive user interface are found within its capability of conforming to a user's needs. The properties of it allow to show only relevant and accurate information based on the current user. This eventually creates less confusion for less experienced users and provides ease of access throughout a system.

Adaptive Resonance Theory (ART)

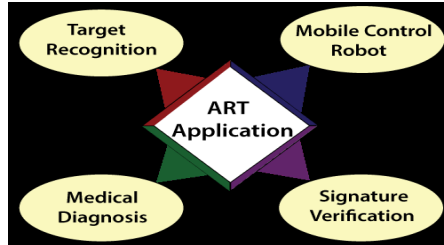


Figure 2. Components of adaptive resonance theory (ART).

Source: Image by Pixabay.

A class of neural organizations dependent on neurophysiologic models for neurons. They were created by Stephen Grossberg in 1976. ART models utilize a secret layer of ideal cases for expectation. On the off chance that an information case is adequately near a current case, it “resounds” with the case; the best case is refreshed to join the new case. Something else, another optimal case is added. ARTs are frequently addressed as having two layers, alluded to as a F1 and F2 layers. The F1 layer plays out the coordinating and the F2 layer picks the outcome. It’s anything but a type of group investigation.

Adaptive Vector Quantization

A neural network approach that sees the vector of inputs as framing a state space and the organization as quantization of those vectors into fewer ideal vectors or locales. As the organization “learns,” it is adjusting the area (and number) of these vectors to the information.

Additive Models

A modeling procedure that uses weighted linear amounts of the possibly changed input factors to foresee the output variable, however does exclude terms, for example, cross-products which rely upon in excess of a single predictor factors. Additive models are utilized in various AI frameworks, for example, boosting, and in Generalized Additive Models (GAMs).

Additivity and Variance Stabilization (AVAS)

AVAS, an abbreviation for Additivity and Variance Stabilization, is a modification of the ACE procedure for smooth relapse models. It’s anything but a difference balancing out change into the ACE method and consequently disposes of a significant number of ACE’s trouble in assessing a smooth relationship.

ADE Monitor

ADE Monitor is a CLIPS-based expert framework that screens patient data for proof that a patient has endured an adverse medication reaction. The framework will incorporate the capability for adjustment by the doctors and will actually want to notify proper organizations when required.

Adjacency Matrix

An Adjacency Matrix is a valuable method to address a binary connection over a finite set. Assuming the cardinality of set, A is n , the Adjacency Matrix for a relation on A will be a $n \times n$ binary matrix, with a one for the i, j -th component if the relationship holds for the i -th and j -th component and a zero in any case. Various way and conclusion calculations verifiably or unequivocally work on the contiguousness lattice. A contiguousness lattice is reflexive in the event that it has ones along the fundamental corner to corner, and is symmetric if the i, j -th component rises to the j, i -th component for all i, j sets in the framework.

Advanced Reasoning Tool (ART)

The Advanced Reasoning Tool (ART) is a LISP engineering language. It's anything but a rule-based framework yet in addition permits frame and procedure representations. It was created by Inference Corporation. A similar shortened form (ART) is additionally used to allude to strategies dependent on Adaptive Resonance Theory.

Advanced Scout

A particular framework, created by IBM during the 1990s, that utilizes Data Mining strategies to arrange and decipher information from b-ball games.

Advice Taker

A program proposed by J. McCarthy that was planned to show practical and improvable conduct. The program was addressed as an arrangement of declarative and imperative sentences. It contemplated through prompt allowance. This framework was a harbinger of the Situational Calculus proposed by McCarthy and Hayes in a 1969 article in Machine Intelligence.

Agenda Based Systems

A surmising interaction that is constrained by a plan or occupation list. It breaks the framework into unequivocal, measured advances. Every one of the sections, or errands, in the work list is some particular assignment to be cultivated during a problem-solving interaction.

Agent Architecture

There are two degrees of specialist engineering, when various specialists are to cooperate for a shared objective. There is the design of the arrangement of specialists, that will decide how they cooperate, and which shouldn't be worried about how singular specialists satisfy their sub-missions; and the engineering of every individual specialist, which decides its inward operations. The design of one programming specialist will allow connections among a large portion of the accompanying parts (contingent upon the specialist's objectives): perceptrors, effectors, correspondence channels, a state model, a model-based reasoner, an organizer/scheduler, a receptive execution screen, its reflexes (which empower the specialist to respond quickly to changes in its current circumstance that it can hardly wait on the organizer to manage), and its objectives. The perceptrors, effectors,

and correspondence channels will likewise empower association with the specialist's external world.

Agent CLIPS

is an expansion of CLIPS that permits the formation of intelligent specialists that can convey on a solitary machine.

Agents

Agents are software programs that are fit for self-governing, adaptable, deliberate and thinking activity in quest for at least one objective. They are intended to make an ideal move because of outside boosts from their current circumstance for the benefit of a human. At the point when different specialists are being utilized together in a framework, singular specialists are required to connect together as fitting to accomplish the objectives of the general framework. Likewise called self-governing specialists, collaborators, intermediaries, bots, droids, insightful specialists, programming specialists.

AI Effect

The great practical advantages of AI applications and surprisingly the presence of AI in numerous software products go generally undetected by numerous individuals in spite of the all-around inescapable utilization of AI strategies in programming. This is the AI impact. Many showcasing individuals don't utilize the expression "man-made reasoning" in any event, when their organization's items depend on some AI procedures. Why not?

It could be on the grounds that AI was oversold in the main jubilant long periods of reasonable standard based master frameworks during the 1980s, with the pinnacle maybe set apart by the Business Week front of July 9, 1984 declaring, Artificial Intelligence, IT'S HERE. James Hogan in his book, Mind Matters, has his own clarification of the AI Effect: "Simulated intelligence scientists talk about a curious wonder known as the "AI Effect."

At the beginning of a venture, the objective is to captivate an exhibition from machines in some assigned region that everybody concurs would require "knowledge" whenever done by a human. On the off chance that the undertaking fizzles, it's anything but an objective of ridicule to be pointed at by the cynics to act as an illustration of the ludicrousness of the possibility that AI could be conceivable. On the off chance that it succeeds, with the interaction demystified and its inward functions exposed as lines

of common PC code, the subject is excused as “not actually too clever all things considered.” Perhaps ... the genuine danger that we oppose is simply the further demystification... It appears to happen over and over again that a line of AI work ... ends up being redirected such a way that ... the actions that should stamp its achievement are exhibited splendidly.

Then, at that point, the subsequent new information commonly invigorates requests for utilization of its anything but a thriving industry, market, and extra feature to our lifestyle appears, which inside 10 years we underestimate; however, by then, at that point, obviously, it’s anything but AI.

AI Languages and Tools

AI software has various prerequisites from other, traditional programming. Accordingly, explicit dialects for AI programming have been created. These incorporate LISP, Prolog, and Smalltalk. While these dialects regularly lessen an opportunity to foster a man-made reasoning application, they can stretch an opportunity to execute the application. Hence, much AI programming is currently written in dialects like C++ and Java, which normally builds improvement time, however, abbreviates execution time. Likewise, to diminish the expense of AI programming, a scope of business programming improvement apparatuses has additionally been created. Stottler Henke has fostered its own restrictive apparatuses for a portion of the specific applications it is insight in making.

AI-QUIC

AI-QUIC is a standard based application utilized by American International Groups guaranteeing segment. It wipes out manual guaranteeing errands and is intended to change rapidly to changes in endorsing rules.

Akaike Information Criteria (AIC)

The AIC is a data-based measure for looking at different models for a similar information. It was inferred by considering the deficiency of exactness in a model when subbing information-based assessments of the boundaries of the model for the right qualities. The condition for this misfortune incorporates a consistent term, characterized by the genuine model, – multiple times the probability for the information given the model in addition to a steady numerous of the quantity of boundaries in the model. Since the initial term, including the obscure genuine model, enters as a steady (for a given