VVIT
VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

UNIT - I
Artificial Intelligence

III / II CSE, R 16 - JNTUK

Dr. T. K. Rao
VVIT

OBJECTIVES

- To have a basic proficiency in a traditional AI language including ability to write simple to moderate programs and to understand code written in that language
- To improve analytical and problem solving skills based on the characteristics of the problem using various heuristic search techniques and to improve designing and playing a game
- To have knowledge on propositional calculus, proportional and predicate logic to understand few systems such as natural deduction, axiomatic system, etc.

Contd..

- To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs.
- To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning
- To have basic knowledge on probabilistic analysis and networks as well as fuzzy systems and fuzzy logics.

OUTCOMES:

- Identify problems that are amenable to solution by AI methods
- And which AI methods may be suited to solve a given problem
- Formalize a given problem in the language/ framework of different AI methods
- Implement basic AI algorithms
- Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports

TEXT BOOKS:

- Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
- Artificial intelligence, A modern Approach , 2nded, Stuart Russel, Peter Norvig, PEA
- Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rded, TMH
- Introduction to Artificial Intelligence, Patterson, PHI

REFERNCE BOOKS

- Artificial intelligence, structures and Strategies for Complex problem solving, - George F Lugar, 5thed, PEA
- Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
- Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

UNIT - I

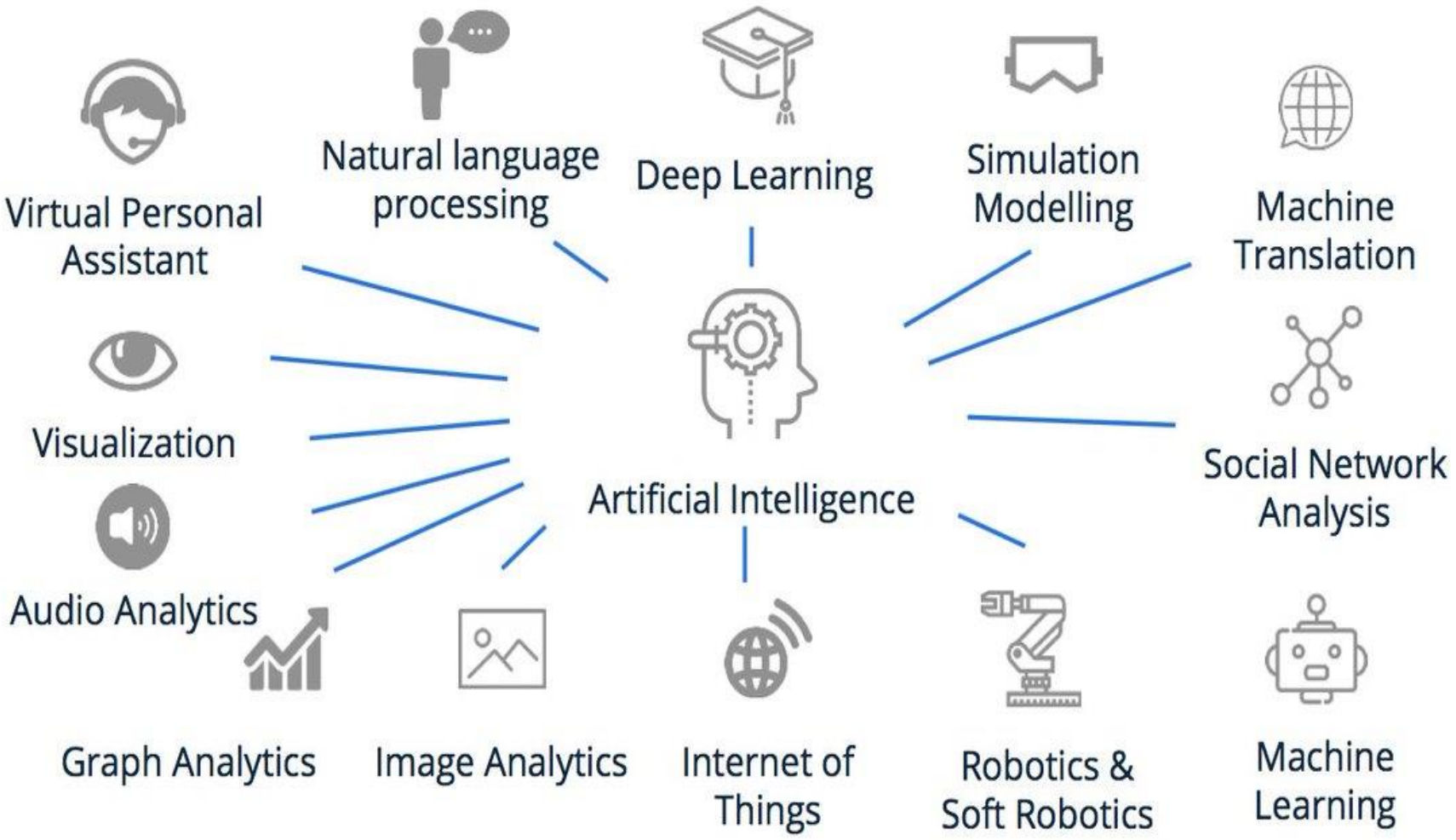
- **Introduction to artificial intelligence:**
  - **Introduction - 1**
  - **History - 2**
  - **Intelligent systems - 3**
  - **Foundations of AI - 7**
  - **Applications - 9**
  - **Tic-tac-toe game playing - 9**
  - **Development of AI languages - 16**
  - **Current trends in AI - 16**

Introduction

- Foundation of AI was laid with Boolean theory by a mathematician, Boole & other researchers
- Since the invention of computer in 1943, AI has been of interest to the researchers
- They always aimed to make machines more intelligent than humans
- AI has grown substantially for last six decades starting from simple to intelligent programs

- AI comprises of a numerous subfields ranging from general purpose areas to specific tasks
- General purpose areas: perception, logical reasoning, et.
- Specific tasks: game playing, theorem proving, diagnosing diseases, etc.
- Scientists of other fields use AI to systematize and automate the intellectual tasks
- AI is engaged in two different significant fields:
  - Science of human intelligence
  - Engineering discipline

Possible applications for Artificial Intelligence



source statista via @mikequindazzi

80+ COMPANIES SECURING THE FUTURE WITH AI

ANTI FRAUD & IDENTITY MANAGEMENT

AGARI, feedzai, Ravelin, smyte., ZYUDLYLABS, 邦盛科技 Bangsun Technology, GreatHorn, pulseiD, skymind, CVU, Castle, GYOMO, rippleshot, simility, veridu, CYBERTONICA, id wall, Shift Technology, sift science, UNFRAUD, DATAVISOR, PRECOGNITIVE, 数美 FMXDATA, SOCURE, trooly

MOBILE SECURITY

appthority, Mi³ Security, Sentegrity, Skycure, ZIMPERIUM.

PREDICTIVE INTELLIGENCE

CYLANCE, deepinstinct, Recorded Future, SEC, indeni, signalsense, INNEFU, ANOMALI, IntelliSpyre, PROTENUS, JASK, patternex, LogRhythm, SentinelOne, SECLYTICS

BEHAVIORAL ANALYTICS / ANOMALY DETECTION

Avata INTELLIGENCE, BehavioSec, DARKTRACE, SPHERICALDEFENCE, 8 SECURITY, RUBICA, CyberX, RedLock, sqrrl, perimeterx, INTERSET, exabeam, intensity analytics, TWOSENSE.AI, SECUREDTOUCH, FORTSCALE, StackPath

AUTOMATED SECURITY

DEMISTO, EdgeWave, JAVELIN, LogicHub, TANIUM, ZENEDGE

CYBER-RISK MANAGEMENT

cybersaint, CYENCE, Cytora, Haystax, lexumo, METACERT, wiretap

APP SECURITY

AuthBase, Cryptosense, CYBER 20/20

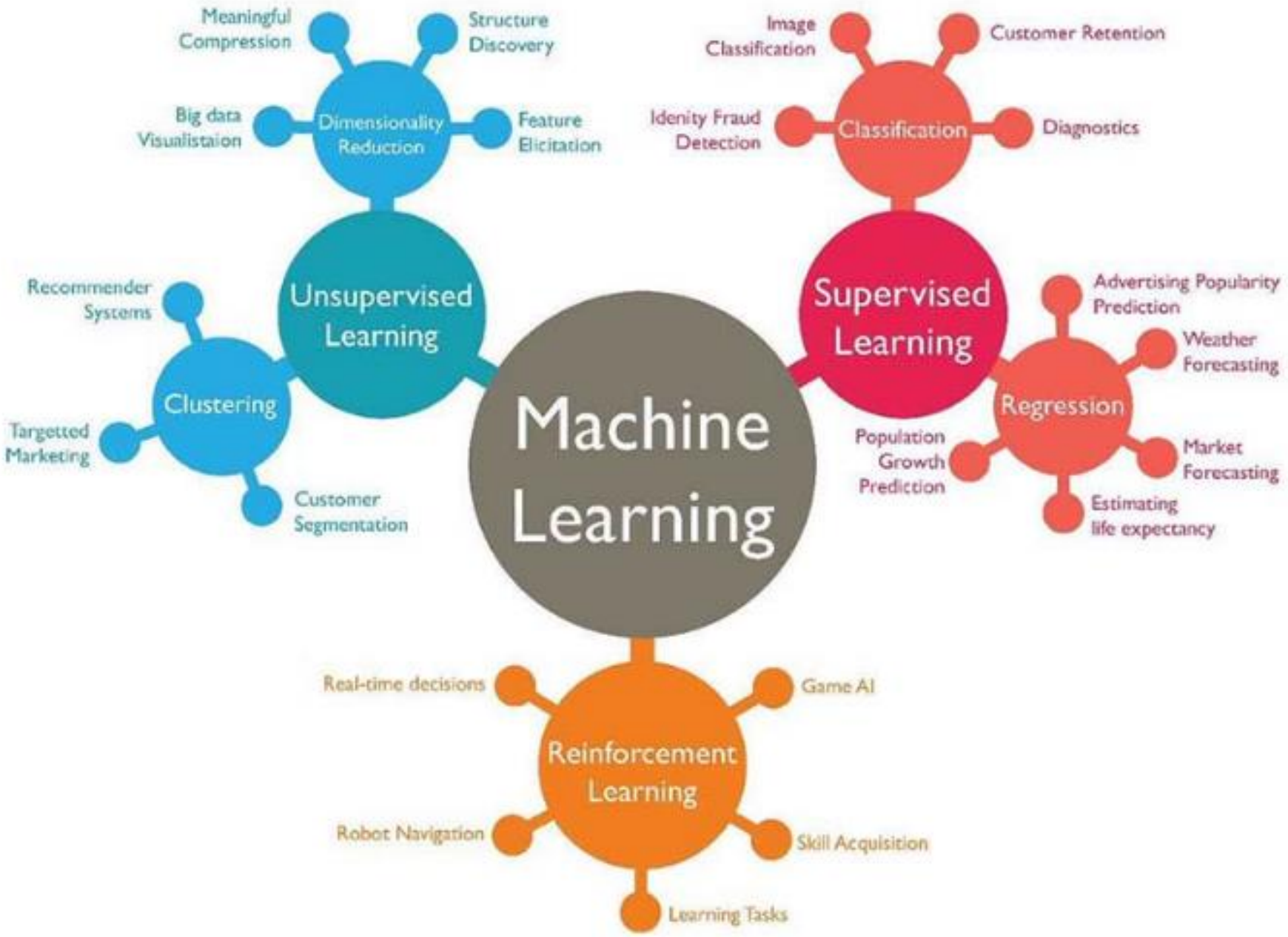
IOT SECURITY

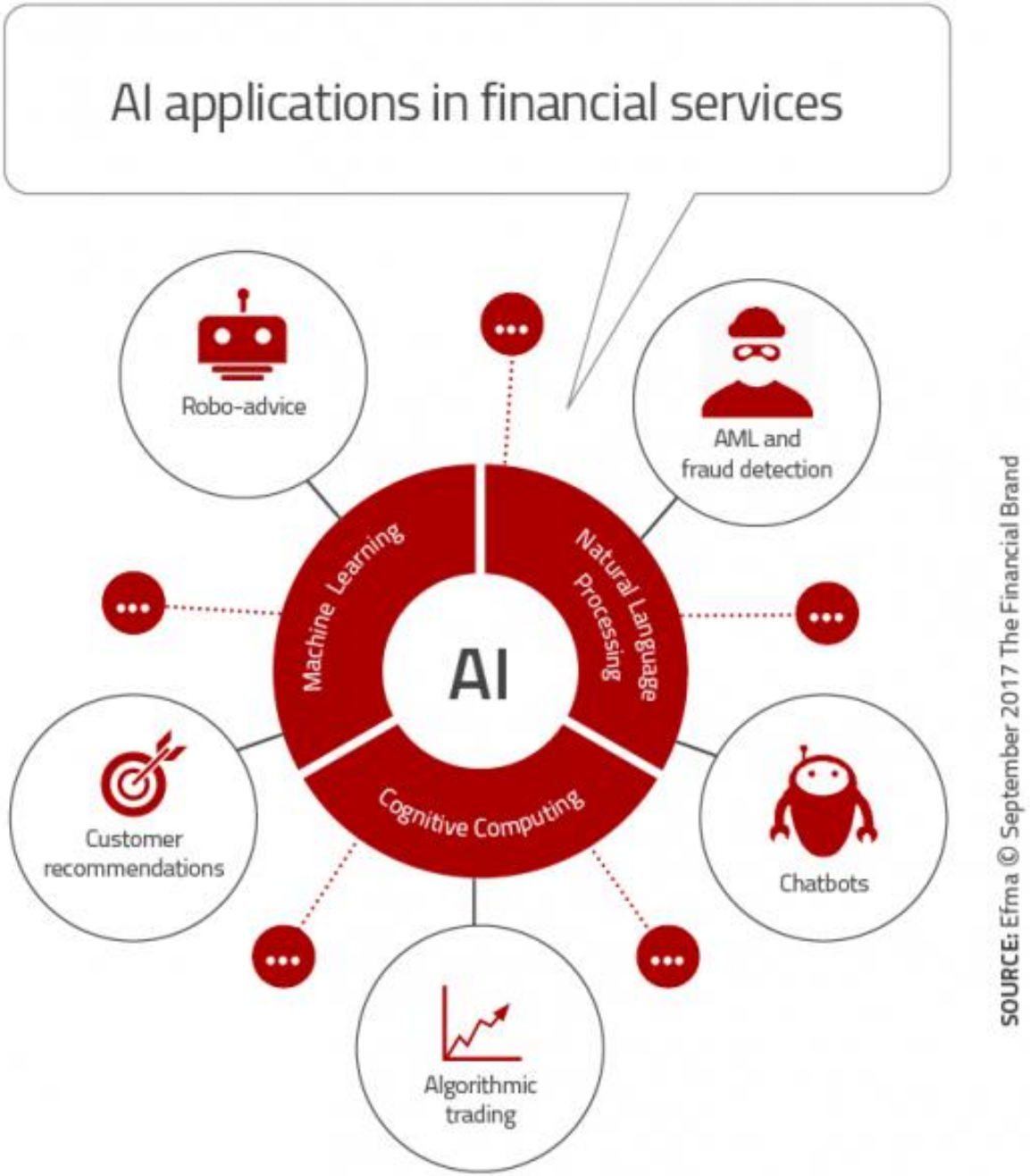
sparkcognition, Bastille, CUJO

DECEPTION SECURITY

CyberFog, illusive

CBINSIGHTS


Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Population Growth Prediction
Market Forecasting
Estimating life expectancy
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks


AI applications in financial services
Robo-advice
AML and fraud detection
Machine Learning
Natural Language Processing
AI
Cognitive Computing
Customer recommendations
Chatbots
Algorithmic trading
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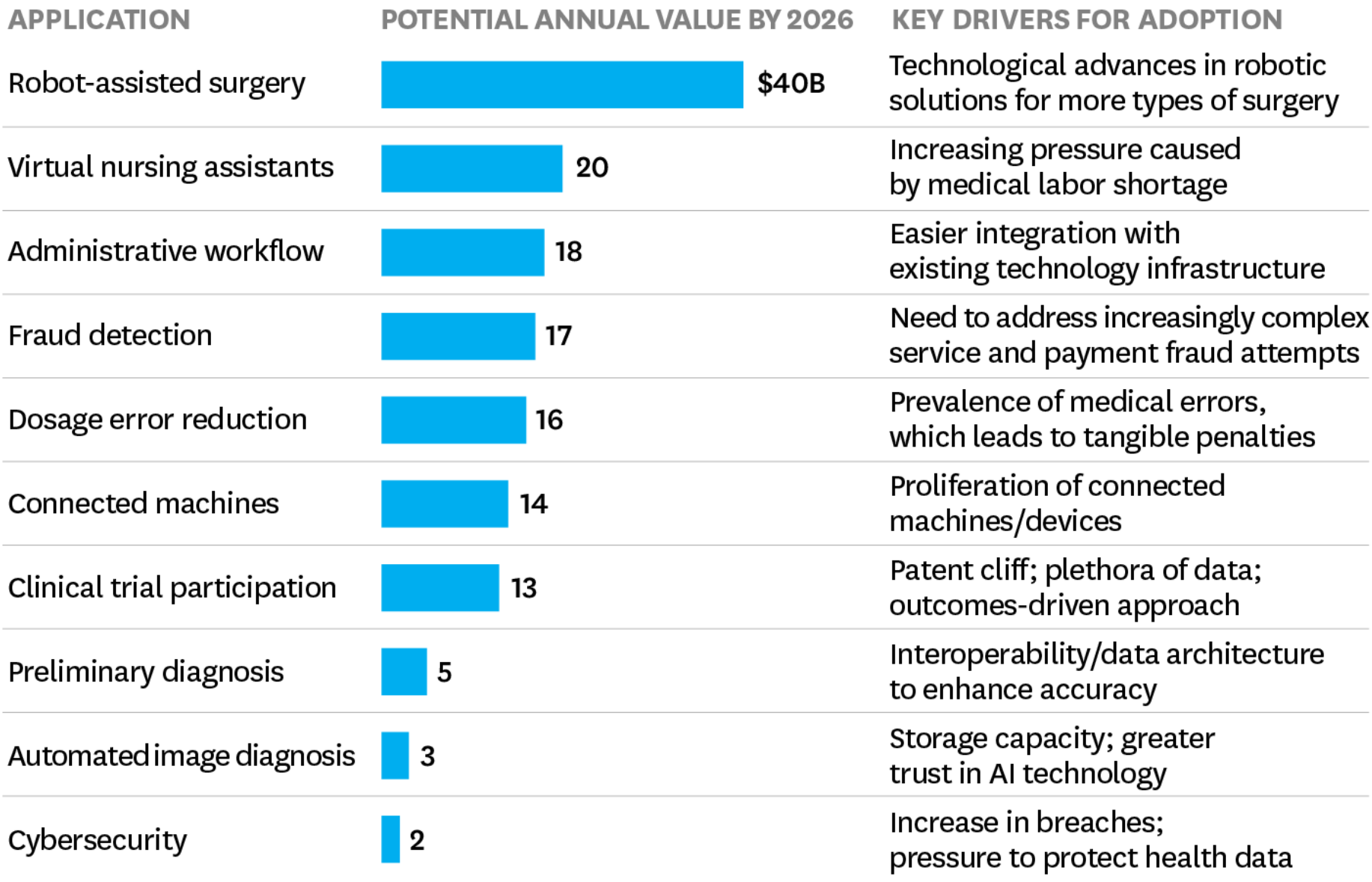
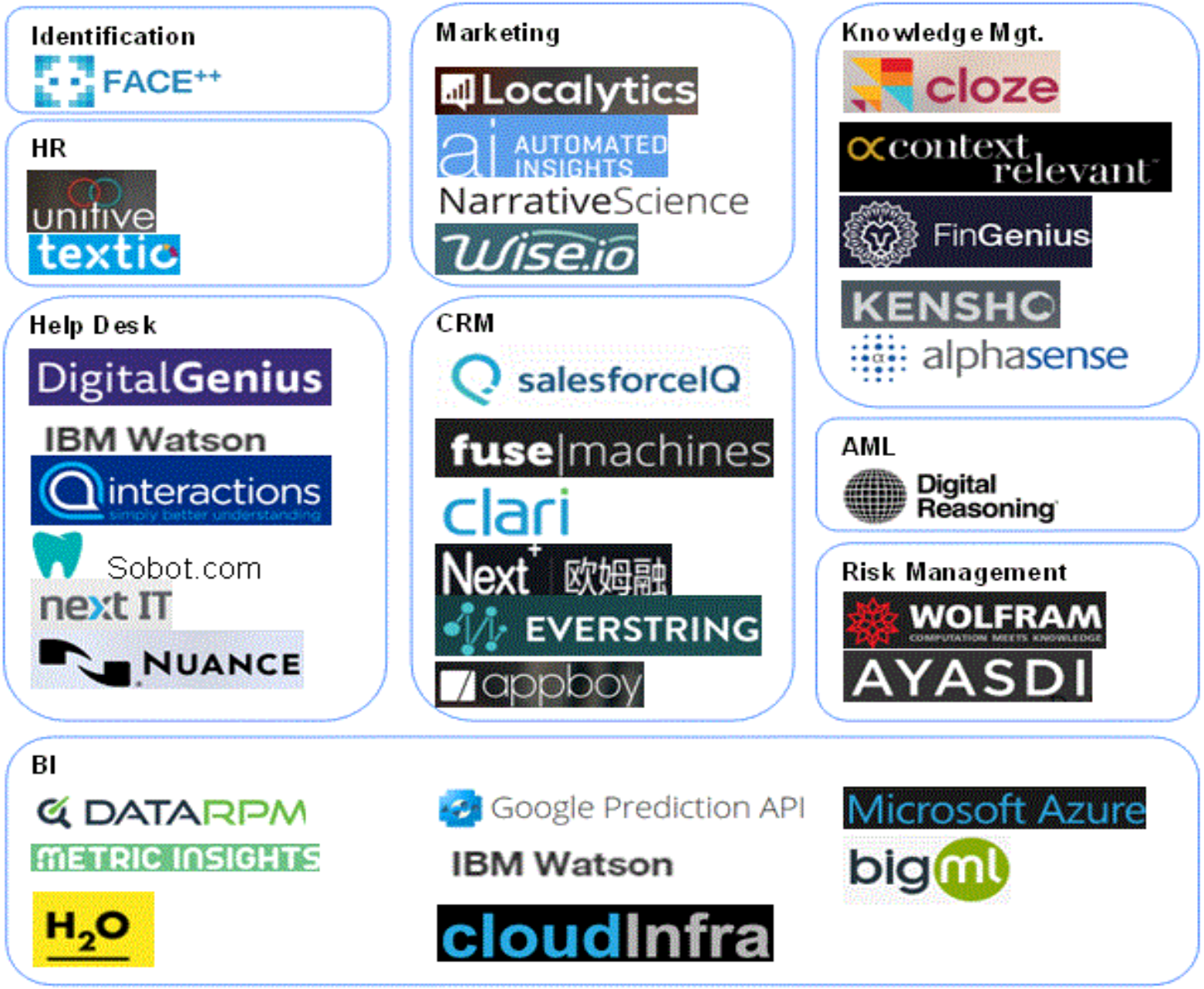
Cybersecurity Domains
Security Architecture
CASB
Federated Identity
Cloud Security
Data Protection
Network Design
Secure Application Development
Baseline Configuration
Secure System Build
Access Control
Identity Management
Privileged Access Management
Identity & Access Management
Security Engineering
Cryptography
Framework and Standard
NIST
ISO/IEC
COBIT
SANS/CSC
Career Development
Training
Certification
Conferences
Peer Groups
Self Study
Physical Security
Risk Assessment
Vulnerability scan
Assets Inventory
4th Party Risk
3rd Party Risk
Penetration test
Blueteam
Social Engineering
Redteam
Application
Infrastructure
Source Code Scan
Blackbox
Whitebox
Data-Centric Risk Assessment
Data-Flow Map
Governance
Laws and Regulations
Industry Specific
Federal
State
Audit
Executive Management Involvement
Risk Informed
Reports and Scorecards
Company's Written Supervisory Procedures (WSPs)
Compliance & Enforcement
KPIs/KRIs
Policy
Procedure
Guideline
Standard
Threat Intelligence
External
Internal
Contextual
IOCs
Intel. Sharing
User Education
Training (new skills)
Awareness (reinforcement)
Security Operation
DR
Recovery
BCP
Detection
Protection
Prevention
SIEM
SOC
Vulnerability Management
Active Defense
Data Leakage
Incident Response
Breach Notification
Containment
Eradication
Investigation
Forensics

10 AI Applications That Could Change Health Care



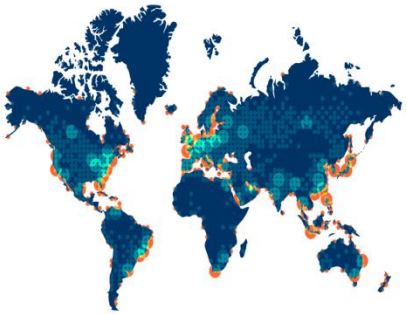
SOURCE ACCENTURE

Selected Firms with AI Banking Applications



5 USE CASES OF AI + ROBOTICS IN AGRICULTURE

ANALYZING SATELLITE IMAGES

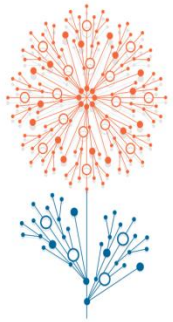


Descartes Labs
farmshots growing with you
Orbital Insight
OmniEarth

IN-FIELD MONITORING

HoneyComb
SkySquirrel technologies
dji
GeoVisual analytics
AGRIEYE
SKYCISION
AIRWOOD
SENSURION AEROSPACE
RAPTOR MAPS
HUVR
GAMAYA
PRECISIONHAWK
RESSON

ASSESSING CROP/SOIL HEALTH

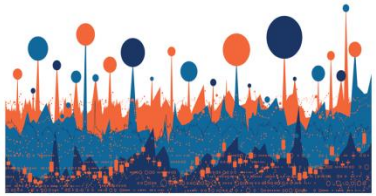


TRACE GENOMICS
indigo
peat
BENSON HILL BIOSYSTEMS

AGRICULTURAL ROBOTS

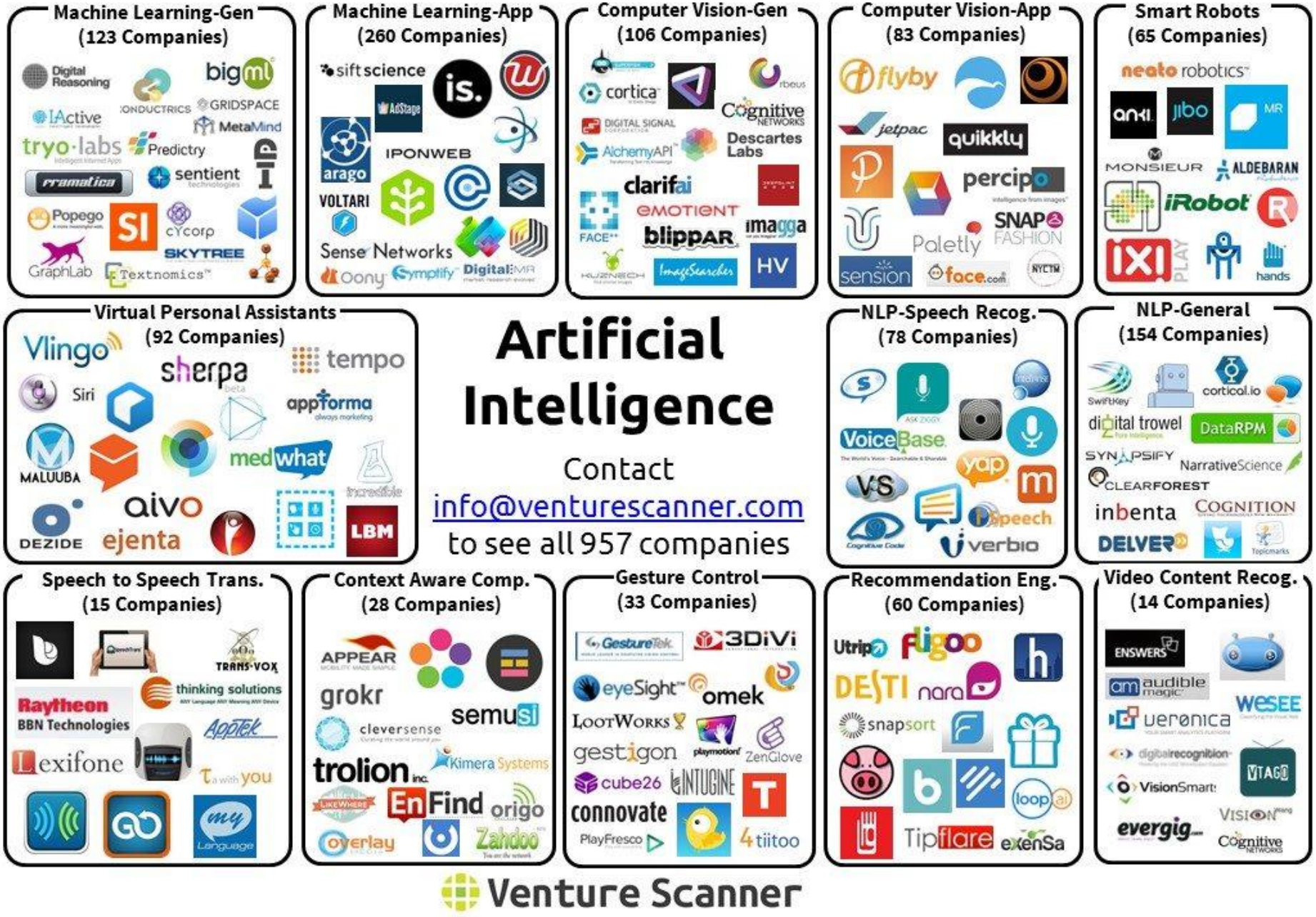
CLEARPATH ROBOTICS™
FarmBot
HARVEST CROO ROBOTICS
BLUE RIVER TECHNOLOGY
abundant ROBOTICS

PREDICTIVE ANALYTICS



ec2ce easyasec
aWhere The Power of Agricultural Intelligence
OPTIMAL applied reinforcement learning

CBINSIGHTS


Machine Learning-Gen
(123 Companies)
Digital Reasoning
bigml
IActive
GRIDSPACE
MetaMind
tryo·labs
Predictry
sentient
Popego
SI
cycorp
SKYTREE
GraphLab
Textnomics
Machine Learning-App
(260 Companies)
sift science
is.
AdStage
IPONWEB
arago
VOLTARI
Sense Networks
Oony
Symplify
Digital:MR
Computer Vision-Gen
(106 Companies)
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rbeus
Cognitive Networks
DIGITAL SIGNAL
AlchemyAPI
Descartes Labs
clarifai
FACE
EMOTIENT
blippAR
imagga
HV
Computer Vision-App
(83 Companies)
flyby
jetpac
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percipo
SNAP FASHION
Paletly
sension
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NYCTM
Smart Robots
(65 Companies)
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IXI PLAY
hands
Virtual Personal Assistants
(92 Companies)
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sherpa
tempo
Siri
appforma
MALUUBA
medwhat
aivo
DEZIDE
ejenta
LBM
Artificial Intelligence
Contact
info@venturescanner.com
to see all 957 companies
NLP-Speech Recog.
(78 Companies)
VoiceBase
yap
VS
Speech
verbio
NLP-General
(154 Companies)
SwiftKey
cortical.io
digital trowel
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SYNAPSIFY
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Lexifone
a with you
Context Aware Comp.
(28 Companies)
APPEAR
grokr
semusi
cleversense
trolion
Kimera Systems
EnFind
origo
overlay
Zahdoo
Gesture Control
(33 Companies)
GestureTek
3DiVi
eyeSight
omek
LootWorks
playmotion
ZenGlove
gestigon
cube26
INTUGINE
connovate
PlayFresco
4tiitoo
Recommendation Eng.
(60 Companies)
Utrip
fliggoo
DESTI
nara
snapsort
loop.ai
Tipflare
exenSa
Video Content Recog.
(14 Companies)
ENSWERS
audible magic
WESEE
ueronica
digitalrecognition
VITAGO
VisionSmart
evergig...
VISION
Cognitive Networks
Venture Scanner

History

- ✓ In 400 B.C, **philosophers** said that, mind operates on knowledge encoded in some internal language
- ✓ **Psychologists** strengthened the idea that, living creatures are **information processing machines**
- ✓ **Mathematicians** provided tools to manipulate certain or uncertain logical statements of certainty as well as probabilistic statements

- John McCarthy organized a conference on machine intelligence in 1956, since then the field is known as AI

- In 1957, a program named GPS (**General Problem Solver**) was developed and tested on problems requiring common sense

- John McCarthy announced his new development i.e., **LISP** (LISt Processing language) in 1958

- MarvinMinsky of MIT demonstrated that computer programs could solve **spatial and logic problems**

- 1960, another program named as **STUDENT** was developed to solve algebraic problems

- L.Zadeh has developed **Fuzzy set and logic** to make decisions under uncertain conditions.

- Terry Winograd at MIT, AI Laboratory developed **SHRDLU**, is a program which carries a simple dialogue with a user in English. This is written in **MACLISP.**

- Minsky also developed **Frame Theory** around 1970 used for storing structured programs to be used by AI programs.

- R.Kowalski developed **PROLOG** language around 1970. (Expert Systems are also developed in the same year)

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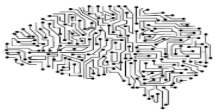


Top 10 milestones in the history of AI.

1950 — The 1st advancement in the field made by Alan Turing through the Turing Test. It said if a machine could carry on a conversation that could not be differentiated from that of a human, then the machine had begun "thinking".

1956 — AI emerged as a field in Computer Science. The term was coined in the Dartmouth Conference.

1974-80 — AI Winters: A very bleak period in the history of AI. Several reports criticized AI. As a result, government spending & interest in the field reduced.

1980-87 — The field revived. The British government started funding AI again to compete with the efforts made by the Japanese. One of the 1st popular AI films- "The Terminator" was released. The film showed a war between machines & humans.

1987-93 — The 2nd AI winter period.

1997 — The field picked up again as IBM's Deep Blue computer beat the reigning world champion- Garry Kasparov.

2001 — Steven Spielberg releases "A.I. Artificial Intelligence"- a tech noir/drama on a robotic boy who dreams to be human.

2011 — IBM's Watson wins "Jeopardy", an American TV quiz show, beating the former champions Brad Rutter and Ken Jennings. In October, Apple introduced Siri, an intelligent personal assistant on its iPhone 4s.

2012 — Google launched its version of Siri- Google Now.

2014 — Amazon Echo was introduced.

Intelligent systems

- AI is combination of Computer Science, Physiology and Philosophy
- AI is a broad area consisting from Machine Vision to Expert Systems
- John Mc Carthy defines intelligence as the computational part of the ability to achieve goals in the world
- Different people think of AI differently and there is no unique definition
- In brief, AI is the study of making machines do things intelligently

- Hence, AI programs must have capability and characteristics of intelligence such as
  - learning,
  - reasoning,
  - inferencing,
  - perceiving and
  - comprehending information
- AI requires an understanding of related terms such as intelligence, knowledge, reasoning, cognition, learning, and few other

- AI programs are not perfect and even make mistakes like humans
- AI programs also can be treated as non-numeric (common sense) ways of solving problems
- AI programs need not be perfect by give reasonably good solutions
- There are two views of AI goals
  - Duplicating what brain does (cognitive science)
  - Duplicating what brain should do (logical thinking)

Eliza

- The very first intelligent system by Joseph Weizenbaum developed in 1964 - 1966
- A program that conversed with user in English
- Able to converse about any subject, since it stored the subjects information in data banks
- It was able to pick up speech patterns from user's questions and provide responses
- The main characteristics of Eliza are briefly mentioned as:

- Simulation of intelligence
  - Eliza programs are not intelligent since they cont understand the meaning
  - They understand the keywords and phrases
- Quality of response
  - It is limited by the sophistication of the ways in which they can process the input
  - Ex. The no.of templates available is a limitation

- Coherence
  - Earlier versions had no structure on the conversation
  - Every statement was based on entirely on the current input and no context info was maintained
  - More complex versions can do better
  - Any intelligence strongly depends on coherence
- Semantics
  - Have no semantic representation of content
  - It does not have intelligence of understanding
  - It imitates the human conversation style

Categorization of Intelligent Systems

- In order to design Intelligent Systems, they are categorized in to four
  - **Systems that think like humans**
  - **Systems that act like humans**
  - **Systems that think rationally**
  - **Systems that act rationally**

- **Systems that think like humans**
  - Requires cognitive modelling approaches
  - Should know the functioning of brain and its mechanism for processing information
  - It is an area of cognitive science
  - The stimuli are converted into mental representation
  - Cognitive processes manipulate it to build new representation to generate actions
  - Neural Network is a computing model for processing information similar to brain

- **Systems that act like humans**
  - Requires the overall behaviour of the system should be human like
- **Systems that think rationally**
  - Relies on logic to measure correctness
  - Logical formulae and theories are used for synthesizing outcomes
  - E.g. John is a human, and all humans are mortal, hence the conclusion is John is mortal
  - Should not that all intelligent behaviours are not by logical deliberation
- **Systems that act rationally**
  - By rational behaviour we mean doing the right thing
  - Though the method is illogical, the observed behaviour must be rational

- To summarize, it can be defined that intelligence is the property of mind which encompasses capabilities like:
  - Reason and draw meaningful conclusions
  - Plan sequences of actions to complete a goal
  - Solve problems
  - Think abstractly
  - Comprehend ideas and help computers to communicate in NL
  - Store knowledge provided before or during interrogation
  - Learn new ideas from environment and new circumstances
  - Offer advice based on rules and situations
  - Learn new concepts and tasks that require high levels of intelligence

Components of AI Program

- AI Program should have:
  - Knowledge base and navigational capacity which contains control strategy and
  - Inference mechanism
- Knowledge base:
  - AI programs should be learning in nature and update its knowledge accordingly
  - it consists of facts and rules and characteristics like voluminous, incomplete, imprecise, dynamic and keep changing

- Control strategy:
  - It determines which rule to be applied
  - For this heuristics, or related thumb rules are used
- Inference mechanism:
  - It requires search through knowledge base
  - Derives new knowledge using existing knowledge with the help of inference rules

Foundations of AI

- Commonly used AI techniques are rule-based, fuzzy logic, neural networks, decision theory, statistics, probability theory, genetic algorithms, etc.
- Since AI is interdisciplinary in general, foundations of AI are
  - Mathematics
  - Neuroscience
  - Control theory
  - Linguistics

Applications

- Business: financial strategies, advising
- Engineering: check design, offer suggestions to create new products, expert systems
- Manufacturing: assembly, inspection, maintenance
- Medicine: monitoring, diagnosing, prescribing
- Education: teaching
- Fraud detection
- Object identification
- Space shuttle scheduling
- Information retrieval

Tic-tac-toe game playing

- The objective is to write a program which never loses
- Three approaches are presented to play the game which increases
  - Complexity
  - Use of generalization
  - Clarity of their knowledge
  - Extensibility of their approach

Approach 1

- 3x3 board is represented as nine element vector
- Each element in a vector can contain any of the following three digits
  - 0- represents blank position
  - 1 – indicates X player move
  - 2 – indicates O player move
- The program makes use of a move table that consist of vector or 3^9 (19683) elements

Table 1.1 Move Table

Index	Current Board Position	New Board Position
0	000000000	000010000
1	000000001	020000001
2	000000002	000100002
3	000000010	002000010
	⋮	

- Initially the board is empty and represented by nine zeros
- The best new board position is 000010000
- All possible board positions are stored in **‘Current Board Position’** column with its corresponding next best possible board position in **‘New Board Position’** column
- Once the table is designed, the program has to simply do the table look up
- The algorithm is as follows

1. View the vector as a ternary number
2. Get an index by converting this vector to its corresponding decimal number
3. Get the vector from new board position stored at the index. The vector thus selected represents the way the board will look after the move that should be made
4. So set board position equal to that vector

Disadvantages

- Requires lot of space to store move table
- Lot of work is required to create move table
- Move table creation is highly error prone
- Cannot be extended to 3D since 3^{27} board positions are required
- This program is not intelligent at all since it does not meet any of AI requirements

Approach 2

- The board B[1..9] is represented by a nine element vector
- Here
  - 2 – represents blank position
  - 3 – indicates X player move
  - 5 – indicates O player move
- There are totally 9 moves in game
- They are represented by an integer 1 for first move and 9 for last move
- We use the following 3 sub procedures

Human strategy

- If human is winning in the next move, then he plays in the desired square
- If he is not winning in next move, then he checks if the opponent is winning
- If so, then he blocks that square

- Go(n) – use this function computer can make a move in square n
- Make_2 – this function helps the computer to make valid 2 moves
- PossWin(p) – if player p can win in the next move, then it returns the index (from 1 to 9) of the square that constitutes a winning move, otherwise it returns a 0
- The function PossWin operates by checking, one at a time, for each of rows/ columns/ diagonals

- If PossWin(p) = 0, then p cannot win
- Find whether opponent can win
- If so, then block it, this can be achieved as
  - If (3*3*2 = 18), then X player can win as there is one blank square
  - If (5*5*2 = 50), then O player wins
- Let us represent computer as C & human as H
- First player is X and second player is O
- The following table consists of rules to be applied by computer for all nine moves

Table 1.2 Rules for Nine Moves

(C plays X, H plays O)	(H plays X, C plays O)
1 move : Go (5) / Go(1)	**2 move :** If B[5] is blank, then Go(5) else Go(1)
3 move : If B[9] is blank, then Go(9) else ***{make 2}*** Go(3)	**4 move:** *{By now human (playing X) has played 2 moves}:* If PossWin(X) then ***{block X}*** Go(PossWin(X)) else ***{make 2}*** Go(Make_2)
5 move : *{By now both have played 2 moves}:* If PossWin(X) then ***{X wins}*** Go(PossWin(X)) else if PossWin(O) ***{block O}*** then Go(PossWin(O)) else if B[7] is blank then Go(7) else Go(3)	**6 move :** {By now computer has played 2 moves}: If PossWin(O) then ***{O wins}*** Go(PossWin(O)) else if PossWin(X) ***{block X}*** then Go(PossWin(X)) else Go(Make_2)
7 & 9 moves : *{By now human (playing O) has played 3 chances}*: If PossWin(X) then ***{X wins}*** Go(PossWin(X)) else ***{block O}*** if PossWin(O) then Go(PossWin(O)) else Go(Anywhere)	**8 move :** *{By now computer has played 3 chances}*: If PossWin(O) then ***{O wins}*** Go(PossWin(O)) else ***{block O}*** if PossWin(X) then Go(PossWin(X)) else Go(Anywhere)

Disadvantages

- Though it can be treated as AI approach since it applies heuristics, it has following disadvantages:
  - Not as efficient as first one w.r.t time
  - Several conditions are checked before each move
  - Still cannot generalize to 3D

Approach 3

- The board is chosen as a magic square of order 3
- The magic square of order n consists of n^2 distinct numbers from 1 to n^2
- The numbers of columns, rows and diagonals some to the same constant

How to create magic squre 3x3

- Begin by placing 1 in the middle of first row
- Subsequently place next numbers diagonally up and to left
- Go down if the work is over

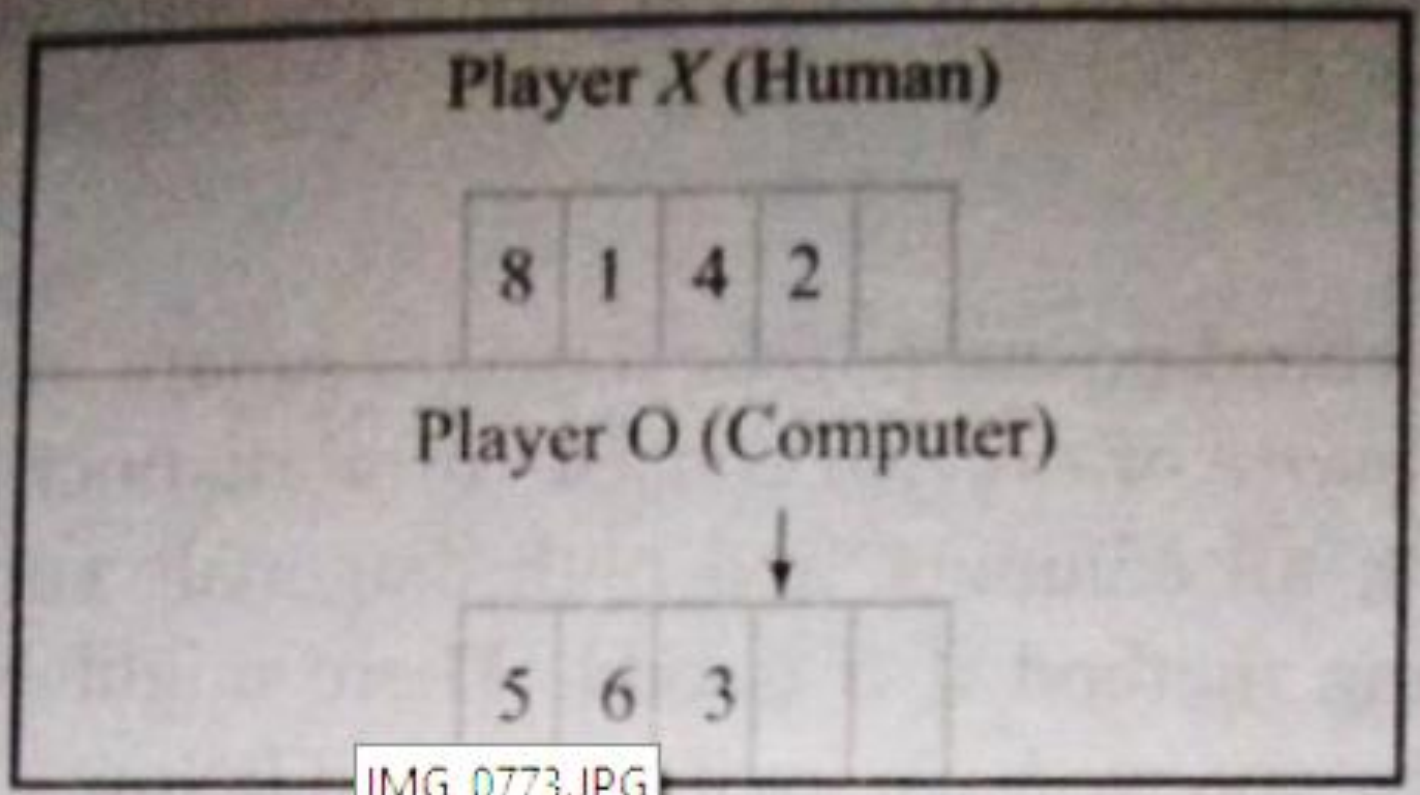
- **The only thing to be remembered is the matrix is wrapped-around**

Table 1.3 Magic Square of Order 3

8	1	6
3	5	7
4	9	2

- In this approach, a list of blocks played by each player is maintained
- Each pair of blocks a player owns is considered
- Difference D between 15 and the sum of the blocks is calculated
- If D<0 or D>9, then those two blocks are not collinear and so can be ignored
- Else if the block representing difference in blank, i.e. not in the list, then player can move in that block

Table 1.4 Status of Both Lists after Seventh Move



1. Suppose H plays in block 8
2. C plays in block 5
3. H plays in block 1
4. C checks if H can win or not
   - Compute sum of blocks played by H
     - S=8+1=9
     - Compute D=15-9=6
   - The sixth block is a winning block for H and not there on either list. So, C blocks 6
5. H plays in block 4
6. C checks if C can win
   - Compute sum of blocks played by C
     - S=5+6=11
     - Compute D=15-11=4; discard this block as it already is in list
   - Now C checks whether H can win
     - Compute sum of pair of square from list of H which have not used earlier
       - S=8+4=12
       - Compute D=15-12=3
     - Block 3 is free, so C plays in block 3.
7. If H plays in block 2 or 9, then computer wins. Lets assume h plays 2
8. C checks if it can win
   - Compute sum of blocks played by C which has not used earlier
     - S=5+3=8
     - Compute D=15-8=7
   - Block 7 is free, so C plays in block 7 and wins the game
9. If H plays in block 7 then there is a draw

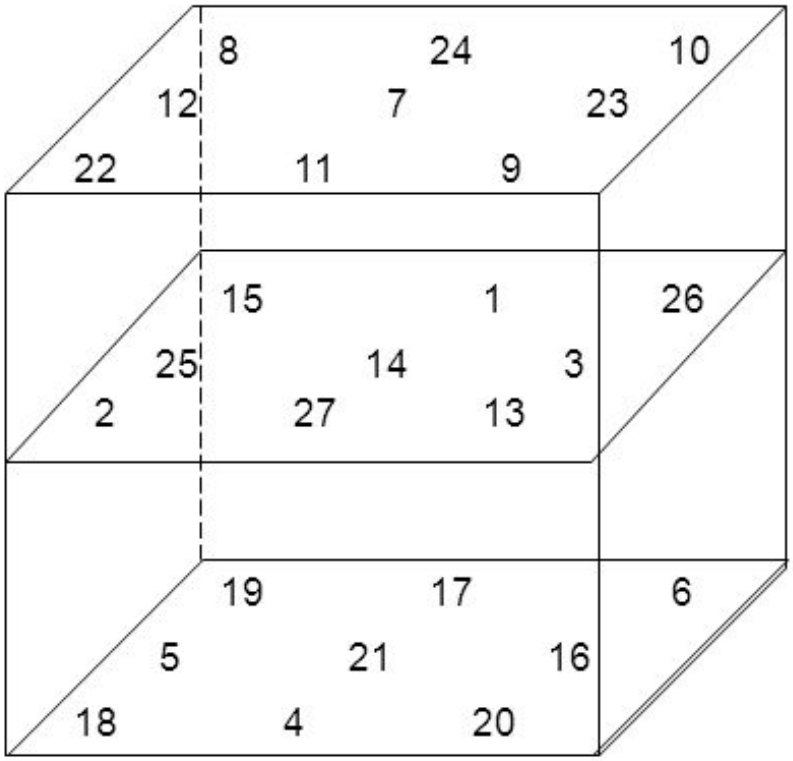
Advantages & Disadvantages

- Program requires much time than other two approaches as it must search all possible moves
- But the advantage is that the approach could be extended to handle 3D tic-tac-toe
- It could also be extended to handle games more complicated than tic-tac-toe

3 Dimensional Tic-Tac-Toe

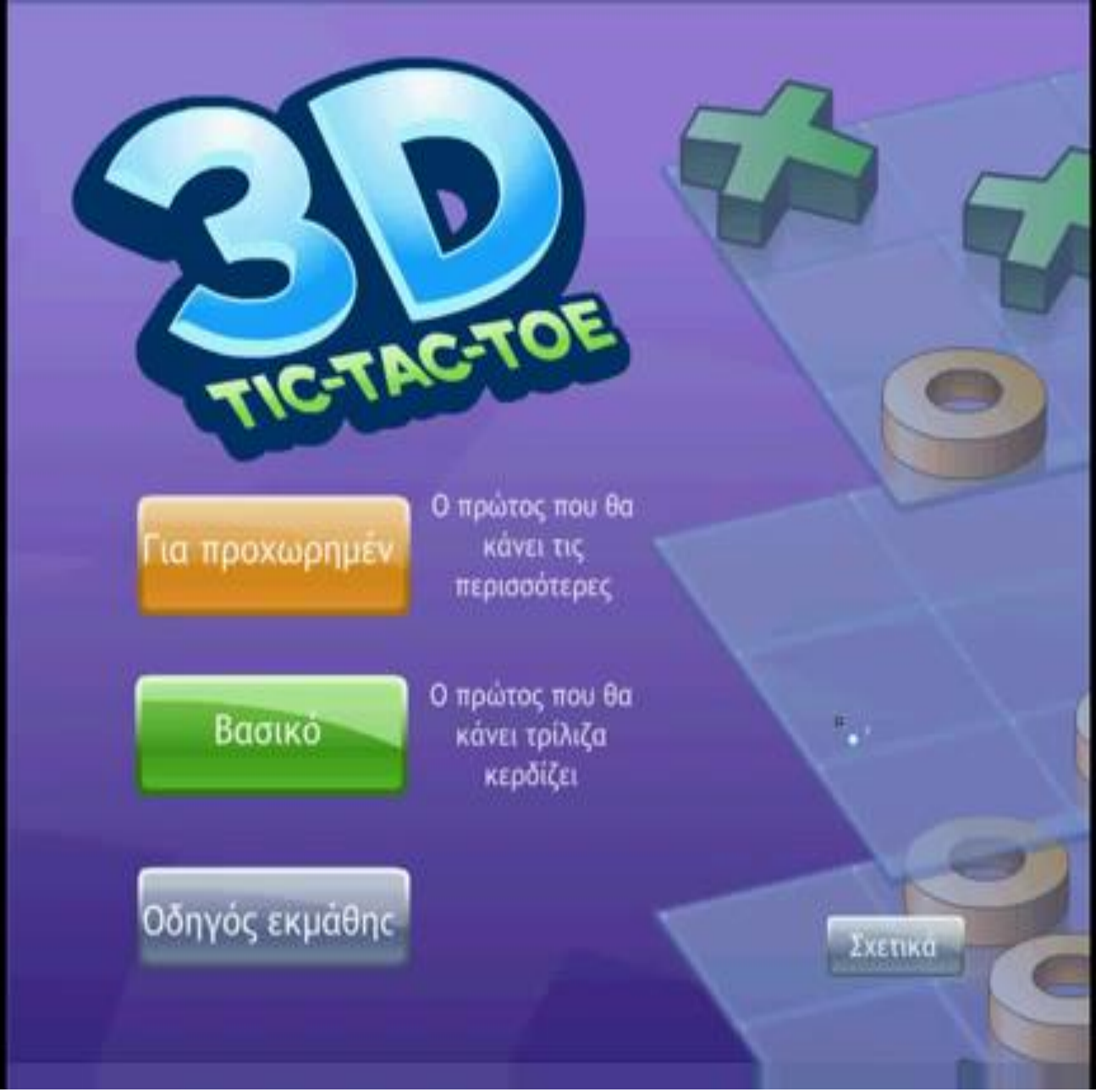
- This is similar to the traditional Tic-Tac-Toe
- But played on a cube of order 3
- Cube is created by stacking 3 grids
- Now the 3 in a row can be on any of the three levels, or between levels
- To win, a player must place three of his symbols on three squares that line up vertical, horizontal or diagonal on a single grid or over all other grids

8	24	10	15	1	26	19	17	6
12	7	23	25	14	3	5	21	16
22	11	9	2	27	13	18	4	20



- Magic Cube has 6 outer and 3 inner and 2 diagonal surfaces
- Outer 6 surfaces are not magic squares as diagonals are not added to 42.
- Inner 5 surfaces are magic square.

- In this game, one may use the magic cube as shown in fig.
- Numbers from 1 to 27 are arranged in a 3x3x3 pattern
- Sum of the numbers on each row, column, diagonal is 42, called magic constant of cube
- The magic cube of order n has a magic constant equal to $n[(n^3+1)/2]$


3D
TIC-TAC-TOE
Για προχωρημέν
Ο πρώτος που θα κάνει τις περισσότερες
Βασικό
Ο πρώτος που θα κάνει τρίλιζα κερδίζει
Οδηγός εκμάθης
Σχετικα

Development of AI languages

- AI languages stress on knowledge representation schemes, pattern matching, flexible search, and programs on data
- E.g. LISP, Pop-2, ML, Prolog, etc.
- LISP is a functional language based on calculus
- Prolog is a logic lang. based on 1st order predicate logic
- Pop-2 is a stack based language providing greater flexibility and has similarity with LISP
- Pop 11 is embedded in an AI programming environments which focuses on domain level
- AI programming can exploit any language from BASIC through C to Smalltalk

Current trends in AI

- Current trends in AI are basically towards the development of technologies which have origin with biological or behavioral phenomena related to human or animals such as evolutionary computation
- Evolutionary computation uses iterative progress, such as growth or development
- It is inspired by biological mechanism or evolution

- Evolutionary paths of AI and simulation started to converge in cognitive psychology
- Simulation has been developed to study and understand complex time varying behaviours exhibited by real physical systems
- ANN has been developed based on functioning of human brain to predict features based on previous details
- Evolutionary techniques mostly involve meta-heuristic optimization algorithms such as evolutionary algorithms and swarm intelligenc

- Genetic algorithms based on Darwin theory of evolution were developed mainly by emulating the nature and behaviour of biological chromosome
- Swarm intelligence is based on the collective behaviour of decentralized, self-organized systems
- Ants, bees and termites etc. solve complex problems by mutual cooperation
- This emergent behaviour of self-organization by a group of social insects is known as swarm intelligence

- In computational sense, the set of mobile agents which are liable to communicate directly or indirectly with each other and which collectively carry out a distributed problem solving is known as swarm intelligence
- Expert systems continues to remain an attractive field for its practical utility in all walks of real life
- Emergence of agent technology as a subfield of AI, is a significant paradigm shift for s/w development