The future of AI in Indie Games

Apex Game Tools

APEX PATH — High-performance pathfinding for dynamic and procedural gameworlds

APEX STEER — Steering, avoidance, formations and crowds

APEX AI — High-performance, general-purpose AI framework

What is the State of AI in Games?

Yesterday's Requirements for AI

Easy to test

Easy to tweak

Easy to extend

Implement by use-case

<1ms budget

3-6 month average development time

Today's Requirements for AI

Complex

Learn by example

Extend to unforeseen scenarios

Emergent behavior

Ultra-high performance

Work with massive game data

For indie games

Little knowledge of AI is likely
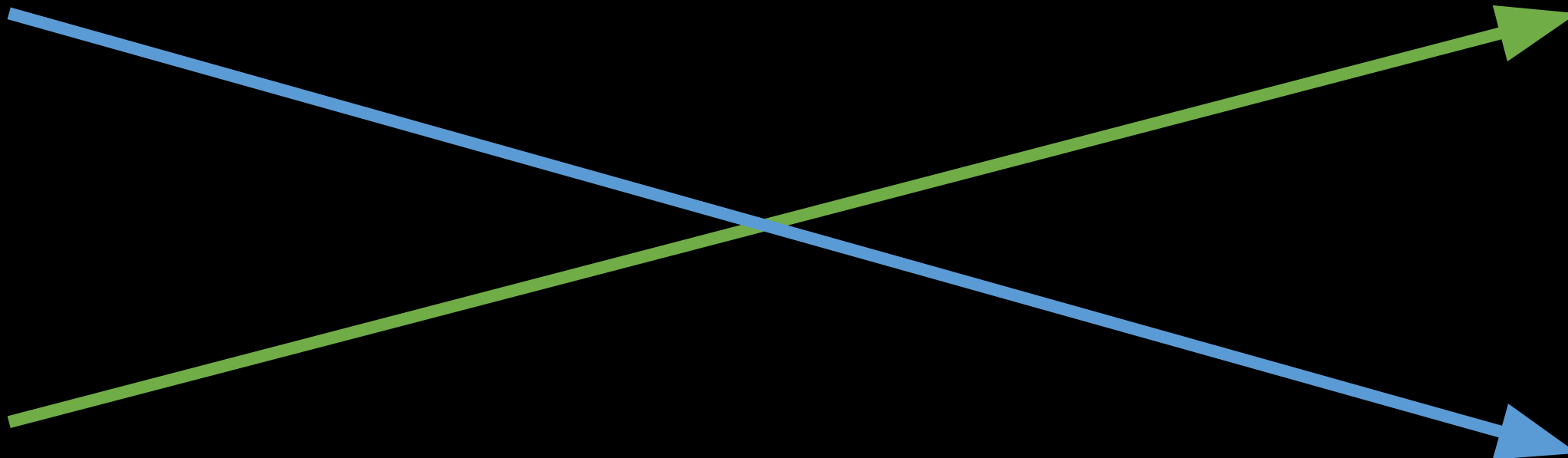
Short timeframe

Small budget

Support non-standard ideas

-> want to realise our game idea without having to worry about technology

Controllability

Complexity

Finite State Machines

Behaviour Trees

Utility AI

Neural Networks

Neuro Evolution

A Tale from Real Life

AI Developer:

"

We used to have a behavior tree system … and everything was running fine until I tried expanding the system for more complex behaviors. The behavior trees were getting huge, harder to maintain than necessary and some performance issues started to creep up …"

So I looked for an alternative and stumbled upon the Utility Theory that made making choices for an AI easy.
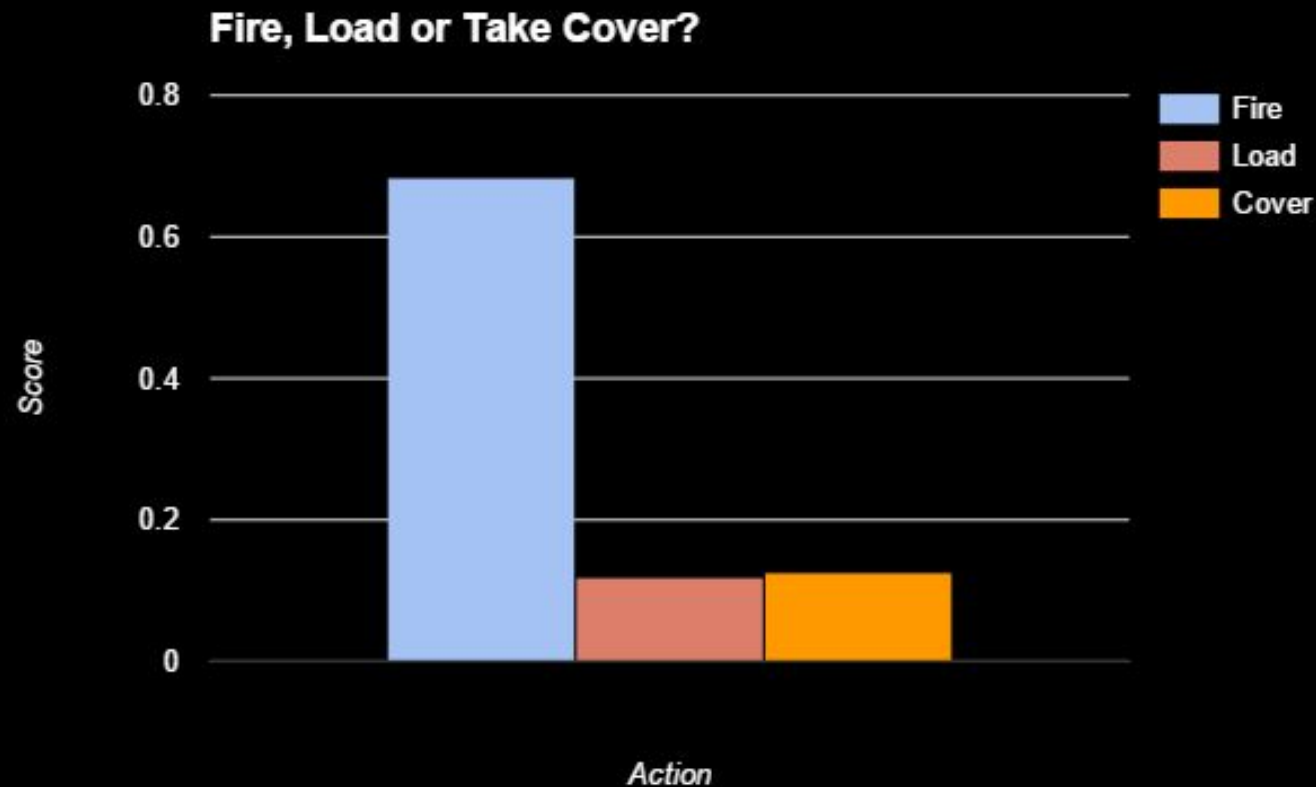
"

Utility AI

Download at: apexgametools.com

Sign up for our machine learning beta at: jr@apexgametools.com

What is a Utility AI?

Comparing different options based on their utility (i.e. usefulness)

Fire, Load or Take Cover?

The use case from the game designer

"If I have energy I will work, except if I am very hungry. However, If I am very sleepy, I will sleep, unless my hunger is extreme. But if my sleep is extreme, then I will sleep first. Of course, if I need to go to the toilet really bad, I will do that. This, however, comes rather urgently…"

What the game designer really means

Time since last sleeping	Time since last slash	Time since last meal	Time of day	Sleepy	Bladder	Hungry	Energy	
48	68	63	26	0.11	0.33	0.55	0.74	Energy
24	76	87	55	0.01	0.88	0.69	0.45	Bladder
19	7	34	93	0.01	0.00	0.43	0.07	Hungry
41	5	20	99	0.07	0.00	0.36	0.01	Hungry
62	50	22	76	0.24	0.00	0.37	0.24	Hungry
28	42	10	64	0.02	0.00	0.28	0.36	Energy
14	12	26	9	0.00	0.00	0.40	0.91	Energy
48	59	64	32	0.11	0.03	0.56	0.68	Energy
91	54	70	48	0.76	0.00	0.59	0.52	Sleepy
95	38	66	77	0.85	0.00	0.56	0.23	Sleepy
83	46	47	51	0.56	0.00	0.49	0.49	Sleepy

Solving this the "old" way

```
if (bladder > urgent)
{
    //loo branch
}
else
{

    if (sleepy > very)
    {
        //sleep branch
    }
    else
    {
        //what if sleep < very && hungry > very…?
    }
}
```

Utility AI

Comparing Desires incl. Bladder

Example #2
Tactical Reasoning

Identify the Best Tactical Position

Dimensions and Categories of the Dialogue

| OptionScorer	What does it do?
PositionProximityToSelf	Scores positions higher that are closer to the position of the AI.
ProximityToNearestEnemy	Scores positions higher that are close to the desired range to the enemy closest to the AI.
OverRangeToClosestEnemy	Scores positions beyond a certain range to the closest enemy with a fixed score.
ProximityToClosestPowerUp	Scores positions higher that are closer to a power up. Only scores relative to the closest powerup.
LineOfSightToAnyEnemy	Scores positions that have line of sight to enemies.
LineOfSightToClosestEnemy	Scores positions based on whether they have line of sight to the enemy closest to the AI.
OverRangeToAnyEnemy	Scores positions beyond a certain range to any enemy with a fixed score.
OverRangeToAnyEnemySpawner	Scores positions beyond a certain range to any enemy spawner.
ProximityToPlayerSpawner	Scores positions higher based on their proximity to the original spawning position of the AI.

Example #3
Dynamic Dialogue

Dimensions and Categories of the Dialogue

Dimension	Category	Input	Curve
Type of item	Healing items	Current health	Logistic
	Weapons	Quality of worn weapons	Linear
	Armor	Quality of worn armor	Exponential
Quality offered	Low quality	Level of the player	Exponential
	Medium quality	Total money spent on items	Exponential
	High quality	Fame in whole realm	Exponential
	Special	Quests solved	Binary
Price	Low	Popularity with merchant	Logistic
	Medium	Money spent with merchant	Exponential
	High	Wealth displayed	Linear

Dimensions and Categories of the Dialogue
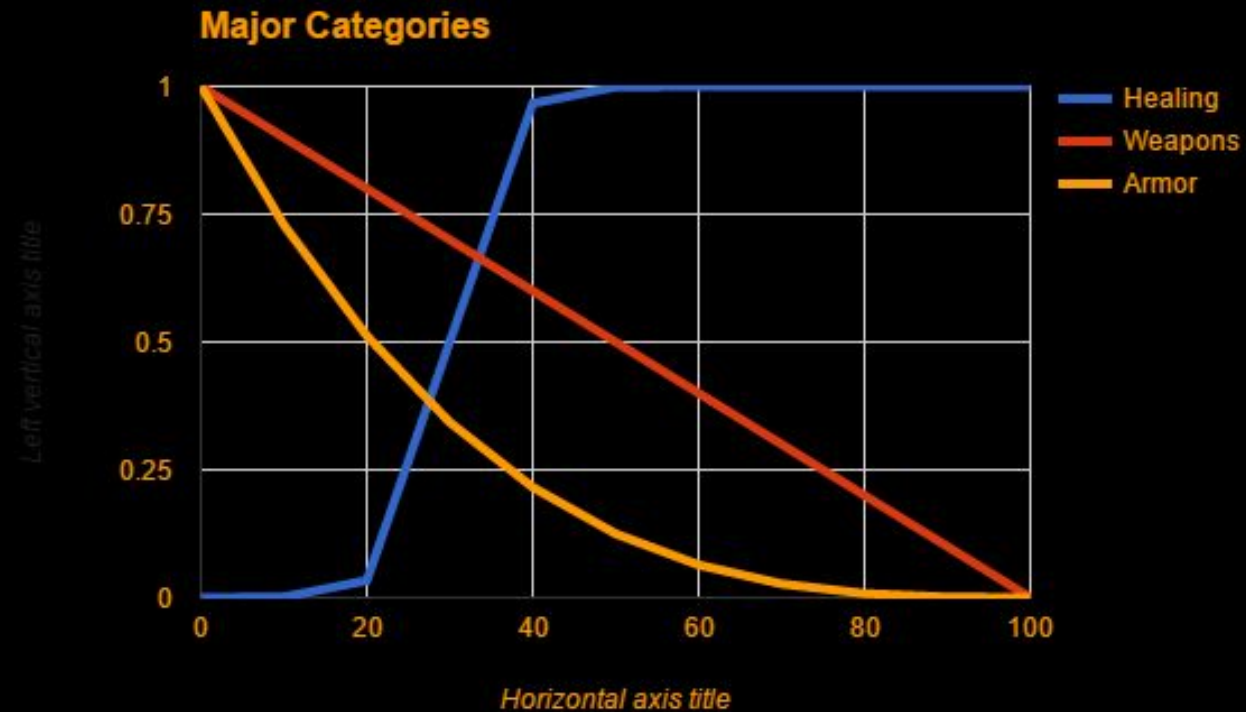
Detailed: Quality Offered
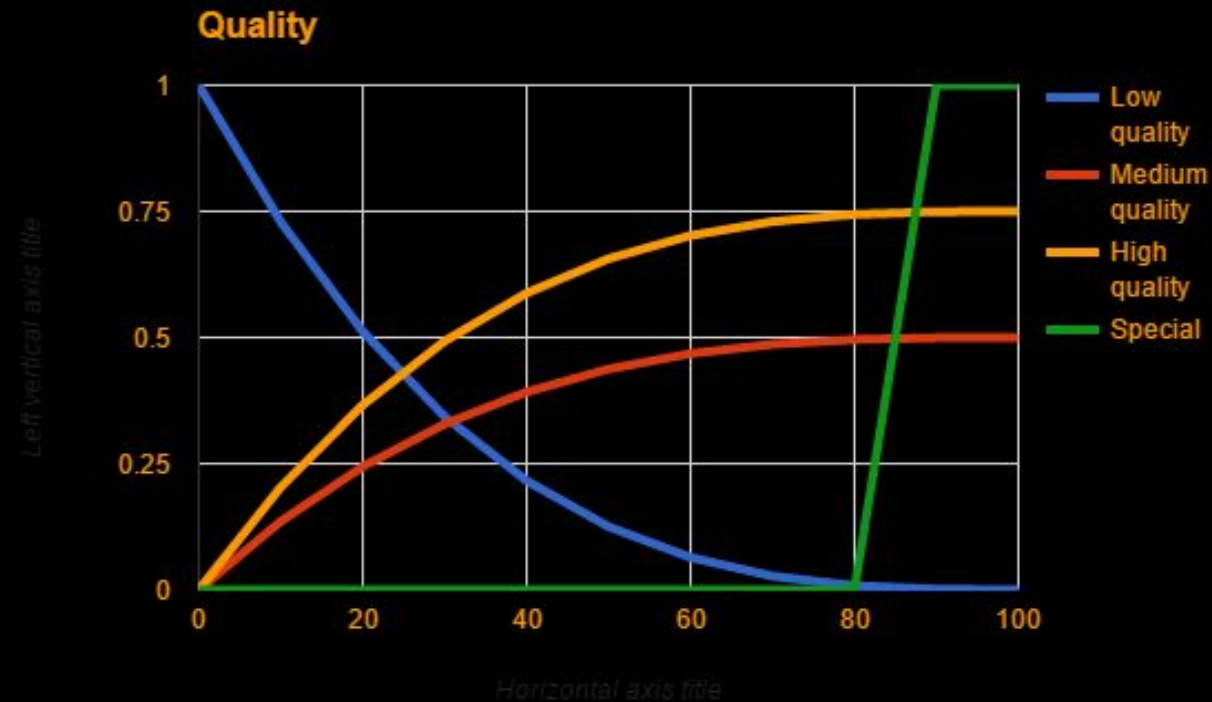
Dialogue Repository

Welcoming message [Extend list to create variety]

"Good Day, Sir"

"Please come in".

"What a fine day today"

Quality Level	Sentence
Low	"An [iron axe] is just what you need. A little worn, but still capable of a good blow".
Medium	"A fine [steel sword] would be a significant improvement"
High	"This [mithril axe] is the finest weapon in my shop. And just suitable for you"
Special	"For you successful services, I offer you the rare [sword of the titans]."

Dialogue Example

"What a fine day today"
"You look like you need better weaponry."
"An [iron axe] is just what you need. A little worn, but still capable of a good blow".
"For a person of your fortune, I ask only [high price]"
"My advice is to strike now"

Example #4
Dynamic Worlds

Script

Bespoke storyline

Vivid dialogue

Large scope of plot lines

Hard-coded

Limited numbers

Limited replayability

Work-intensive

Risk of being irrelevant

Ecosystem

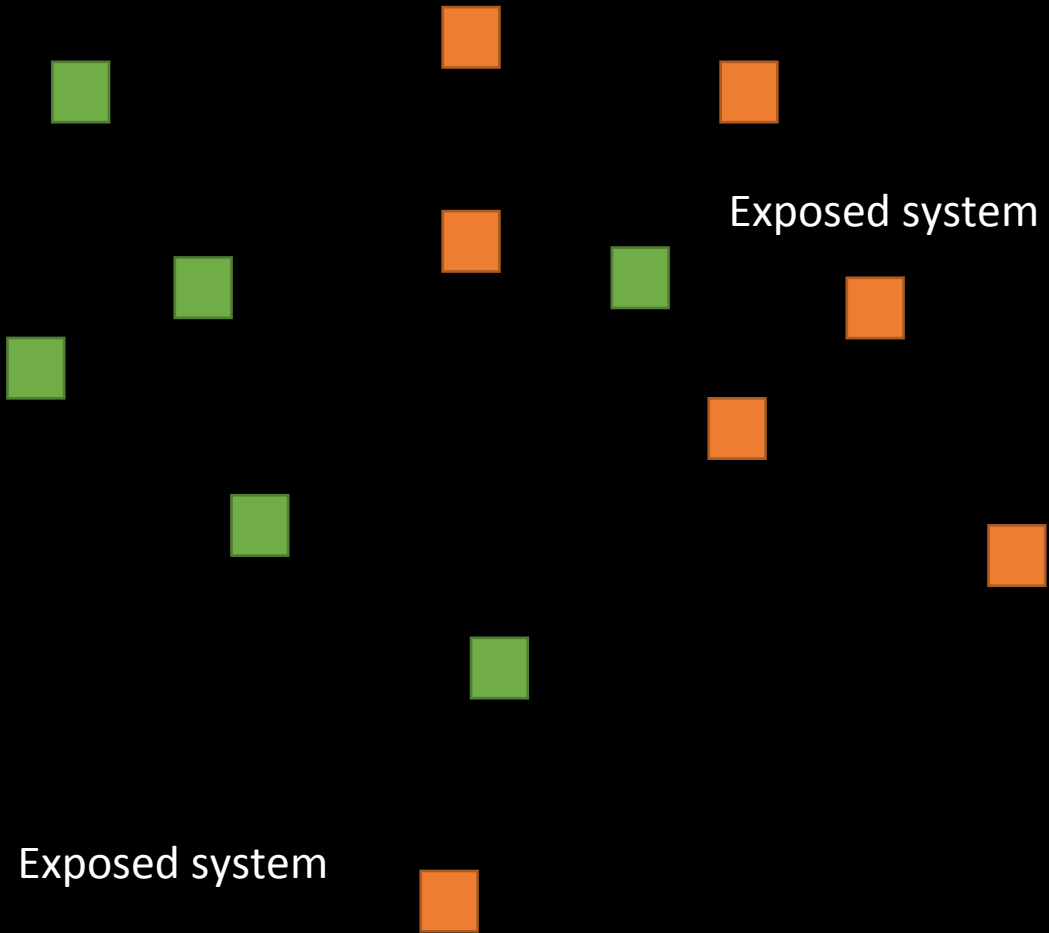Based on actual situation

Endless numbers

Context-sensitive

Need carefully balanced system

Risk of repetitiveness

Contextual AI

Exposed system

Exposed system

Score Star Systems

Scorer	
OwnStrength	The military strength of the system
TotalInfluenceFromAllies	The military strength of allies, adjusted for e.g. range or loyalty
TotalInfluenceFromEnemies	The military strength of enemies, adjusted for e.g. range or loyalty
ImportanceToStrategicGoals	Importance to the current strategic goals - e.g. defined elsewhere
ValueOfSpecialResources	Value of special resources or facilities in this system
SymbolicImportance	The importance of this system to e.g. this faction for the story - e.g. homeworld etc.

Faction personalities

Aggressive

"We want you to assault the outlying enemy system"

Defensive

"We want you to defend our outlying system"

Long-term memory

Aggressive

"We haven't forgotten that you didn't help us attack the outlying system"

Defensive

"We are very disappointed that you didn't come to our defences the last time our systems were exposed"

The possibilities are endless

- Attack
- Defence
- Blockade
- Bounty
- Patrol
- Exploration
- Guard trade routes
- Conquest
- Invade
- Domination
- Treason

- Pardoning
- Spying
- Sell information
- Extract information
- Steal technology / resources etc
- Alliances
- Neutrality
- Divide & conquer

Questions?

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Sign up for our machine learning beta at: jr@apexgametools.com

Questions?

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RTS Template:

https://github.com/RamiAhmed/ApexTeaching
Survival Shooter template: https://www.assetstore.unity3d.com/en/#!/content/57846

Utility AI
API License Key: order_56ec15e3a3d3f_am_RakQtmNmm2mJ

API License Email: ngj@apexgametools.com

https://www.dropbox.com/s/75mu4b00a6xhvxx/Apex-AI-Default.zip?dl=0