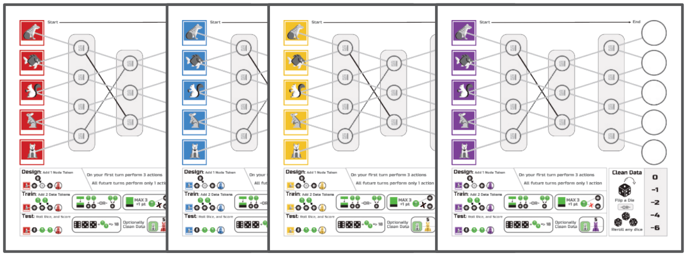
Overview

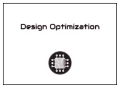
You are a data scientist at FuzzNet Labs a startup creating a service for identifying cute animals in photos. This is becoming a hot market so you will need to compete against the other startups in this space. Whoever gets to market first will have an advantage, but at the end of the day the best model will win.

Components

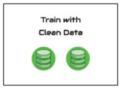
4 Player Boards



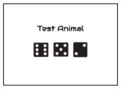
6 Design Cards



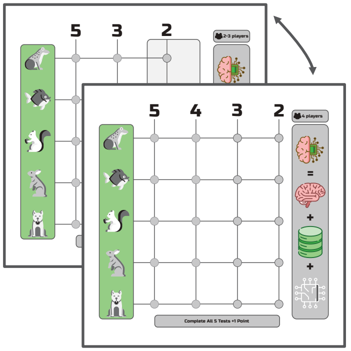
5 Training Cards



5 Test Cards



1 Score Board



Animal Figures

1 First Player Marker

4 Data Clean Token

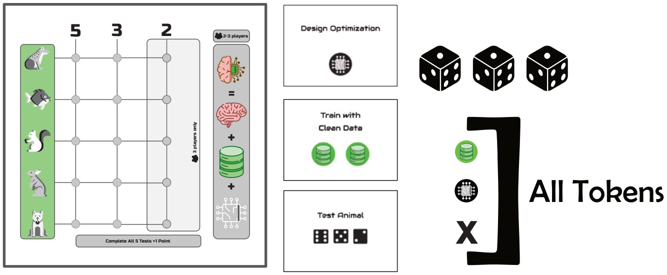
44 Node Tokens

X 15 Overfitting Tokens

100 Data Tokens

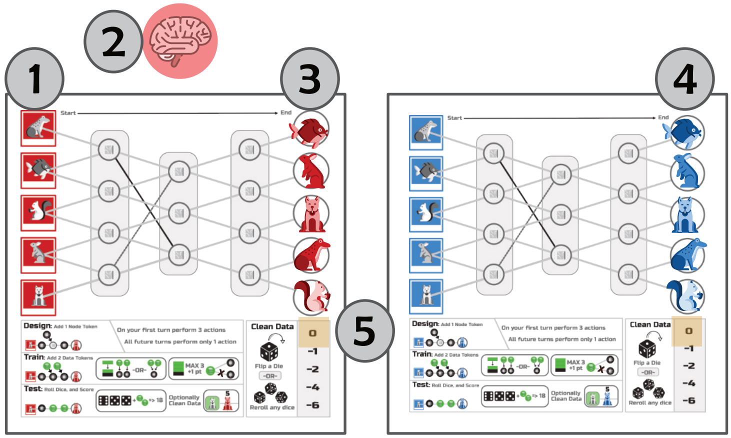
Set Up

Center of Table Set Up



1. Place the Score Board, Design Cards, Training Cards and Test Cards in the middle of the table.
2. Place the Score Board side face up that matches the number of players for your game.
3. Place the dice, Train Cards, Node Tokens, Data Tokens and Overfitting Tokens within arms reach of all players.

Player Set Up



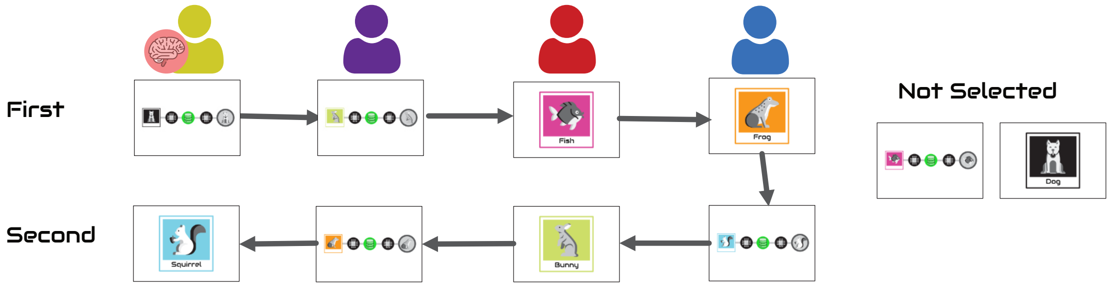
1. Each player receives a player board, and Animal Tokens of a single matching color.
2. Determine who will go first by the method of your choice. Give a player the First Player Marker.
3. The first player places all of their Animal Tokens on their board on the right most column in any order.
4. All players must set up their Animal Tokens on their Player Boards to match the first players' board.
5. Each player places a Data Clean Token at the 0 place on the data clean tracker.

Set Up Continued

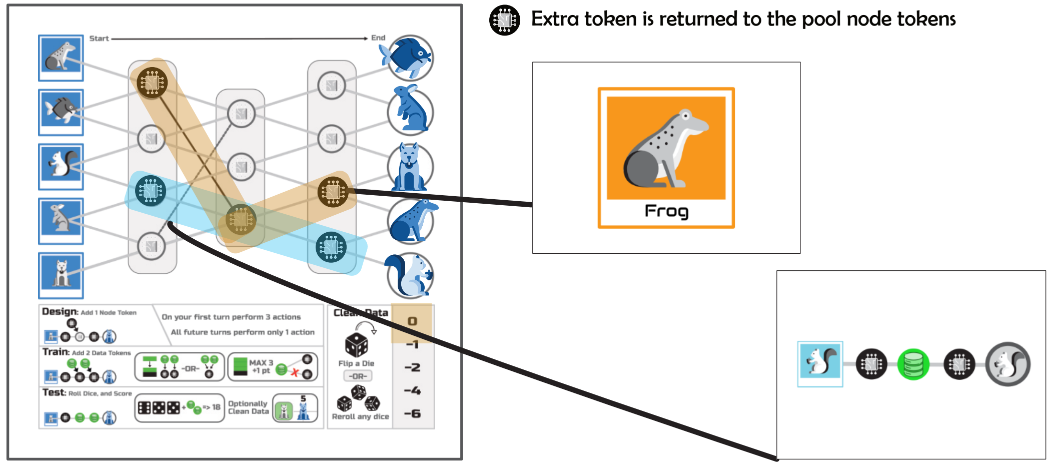
Before play starts players will preseed their boards with up to 6 node tokens.

1. Place Training Cards and Test Cards face up in the middle of the table.
   - 2 Player (Only use the Training Cards represents 1 or each animal)
   - 3-4 Players (Represents 2 of each animal)

2. Starting with the first player, players take turns in clockwise order selecting one card. Once the last player has takens a card, the turn order reverses (counter-clockwise) and players select again in the opposite direction. This continues until each player has exactly two cards. Players cannot select the same animal twice. Train and Test Cards do not represent anything different, they just represent the animal you must target in step 3.

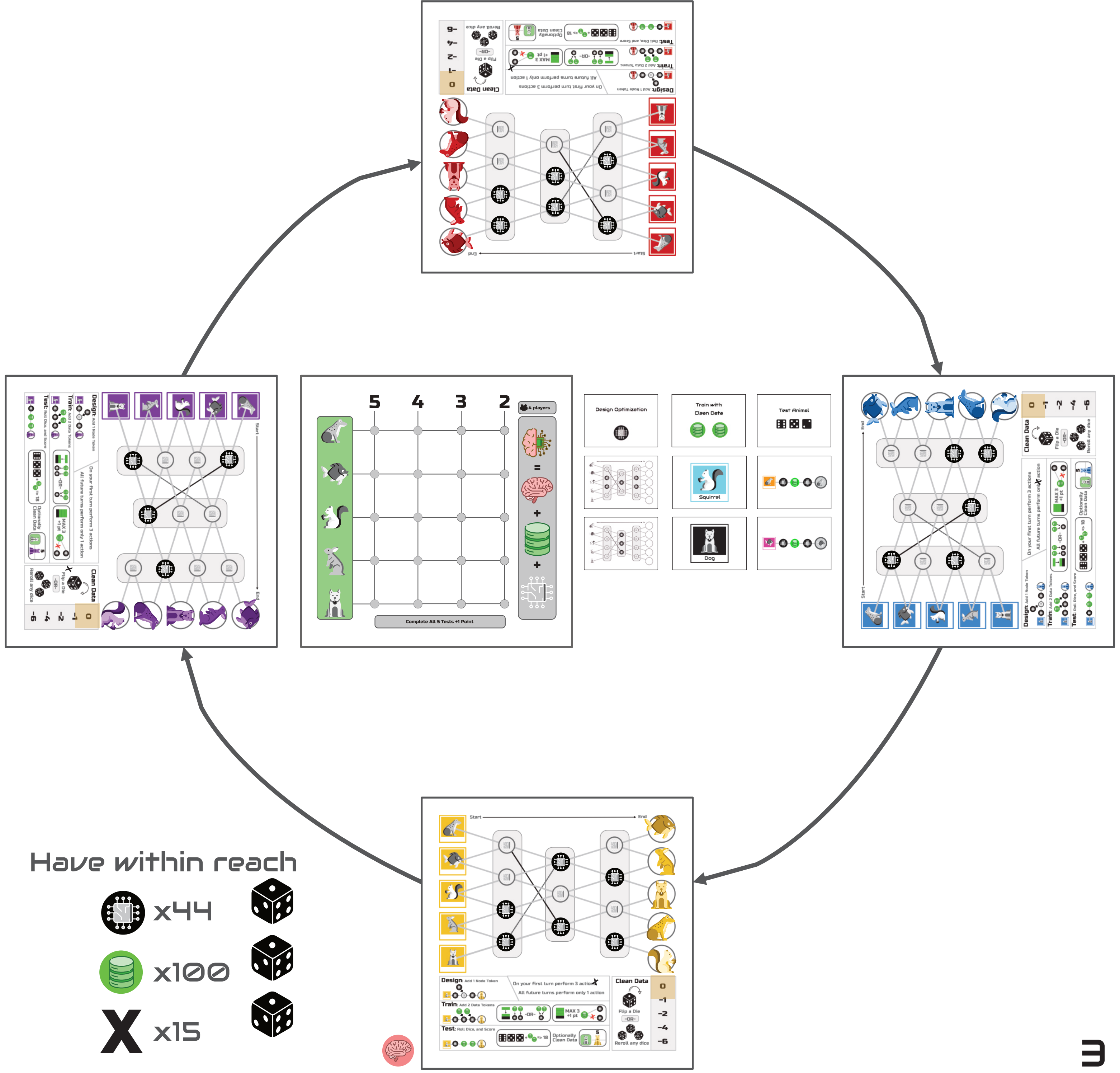


3. Players can only place node tokens that support completing paths for the animals on the cards they selected. The node tokens may support the completion of another animal the player does not have a training card for. Players do not have to choose they most optomized path. Any remaining node tokens cannot be placed. Refer to the Design Model section on page 4 for node token placement rules.


Extra token is returned to the pool node tokens

4. After all players finish setting up their boards, do the following for the Design, Train, and Test cards (each in a separate pile):
   - A. Shuffle the pile.
   - B. Place it in the center of the table.
   - C. Reveal two cards.

Set Up Example



Gameplay Overview

Play starts with the first player and continues in clockwise order around the table. Players take one and only action on their turn.

Actions a player can take:

- Design Model - Enables you to perform a test for a specific animal.
- Train Model - Increases the probability of a successful test.
- Test Model - Test a specific animal to score points.
- Refresh - Discard Design, Training and Test Cards

Game end is triggered by either:

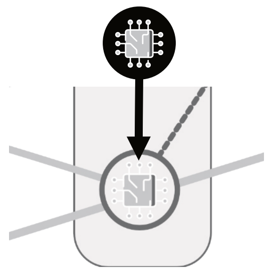
- A player successfully pass tests for all 5 of their Animal Tokens.
- Testing becomes impossible. This occurs if players do too much training and create too many blocked paths through overfitting. Explained on page 5.

After game end is triggered, play continues clockwise until all players have had the same number of turns.

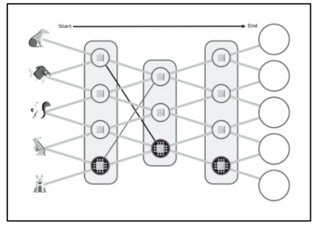
Design Model

In the design stage you are building paths for each animal, so they can be tested. This is explained more on page 6 in the Test Model section.

Select 1 Design Card revealed in the middle of the table. Add 1 Node Token on your Player Board in one of the areas that match the selected Design Card.



Player Board Placement

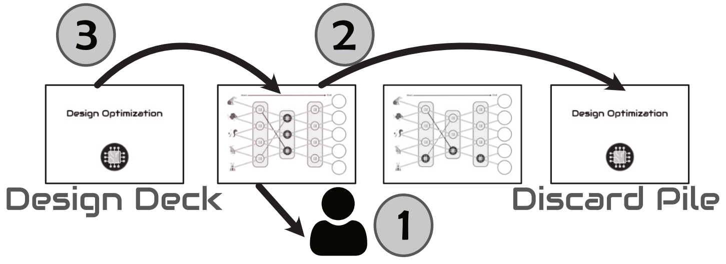


Can only place on the bottom 3 nodes on your placyer board.

Design Model Continued

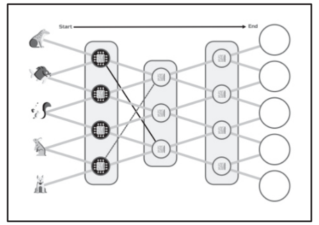
Node Tokens cannot be removed or transferred to another node once it is placed.

After the Node Token is placed discard the Design Card and replace it with a new one from the Design Card deck. If there are no cards in the Design Card Deck, shuffle the discard pile and it becomes the Design Card Deck.

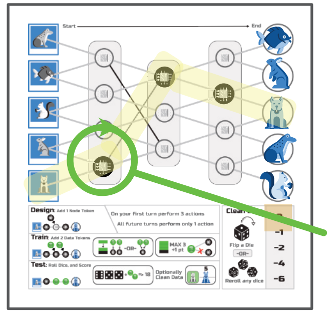


If have all players have filled the nodes that a given Design Card indicates are legal placements. Remove it from the game and replace with a new Design Card. This ends the players turn.

Example Design Gameplay



If this is the selected Design Card they can only place a node token in the first column.



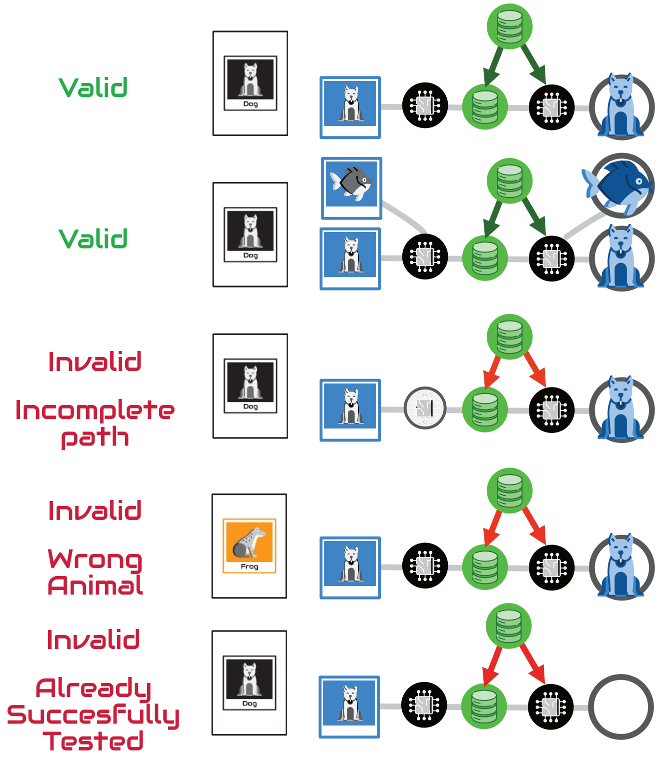
The player wants to evantually test dog, so is trying to complete a path to it.

They place the node token in the bottom slot in the first column, as it supports their goal and they can legally do it.

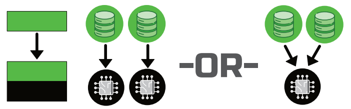
Train Model

Train a model by adding data to it, so you increase your odds of a successful test. Select 1 Training Card revealed in the middle of the table. The player cannot select the card if they have already successfully tested the animal.

- Add 2 Data Tokens on top of a Node Token on your Player Board.
- The Data Tokens must be placed on a completed path for the animal on the selected Training Card. This represents that the player has obtained clean labeled data for this animal. It can also support a path going to other animals, but it must support the completed path for the animal on the players selected Training Card. It cannot be for an animal you have already successfully tested for.



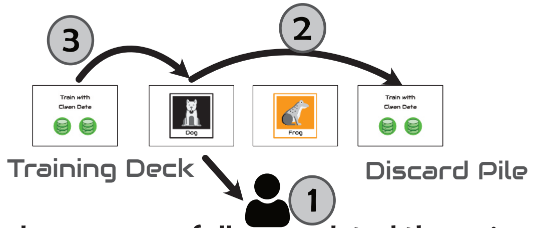
- Data Tokens may be placed on the same node or on 2 different nodes.



Train Model Continued

- Data Tokens cannot be removed or transferred after they are placed.
- For each Data Token on a node will add +1 when calculating a successful test. This increases the probability of a successful test. Explained on page 6.

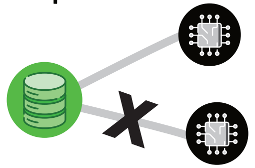
After the Data Tokens are placed discarded the Training Card and replace it with a new one from the Training Card deck. If there are no cards in the Training Card Deck, shuffle the discard pile and it becomes the Training Card Deck.



If all players successfully completed the animal indicated on the given Training Card. Remove it from the game and replace with a new Training Card. This ends the players turn.

Overfitting

Max 3 Data Tokens per node. This means you have a highly trained node, but there might be an overfitting problem. Overfitting is when the data in your model is too heavily biased to give accurate responses.



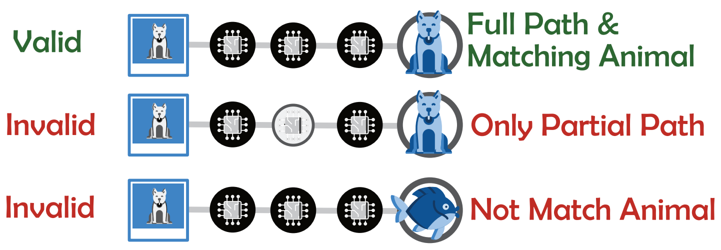
- Place an Overfitting Token on one of the lines/paths from the maxed node to one of the next nodes of your choice. This makes it so this path cannot be used for testing.

- You get +1 point for each maxed out node for having a highly trained model.

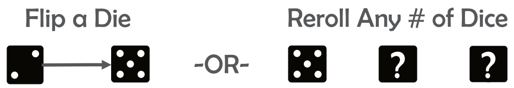
- If a path is no longer needed because you have already successfully tested a specific animal there is no downside of blocking off the path.
- It is possible to block off all paths that can lead to testing a specific animal, so be careful.

Test Model

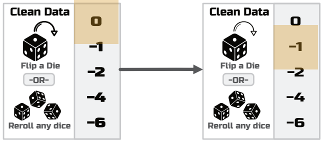
1. Identify a path to test, which are 3 nodes with Node Tokens that connect an animal on the left of the player board with the matching Animal Token.



2. Roll the 3 dice.
3. You may use the clean data action to modify the value of your dice:
   1. Either reroll any number of dice or flip a single die (1->6, 2 ->5, 3->4).



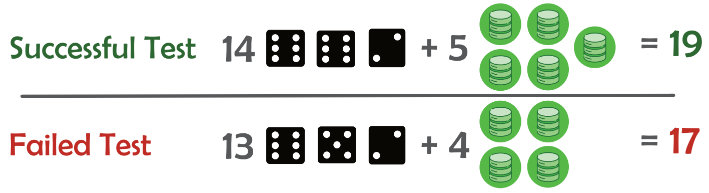
   2. Then slide the Clean Data Token down 1 space on your player board.



> Each player can do this action a maximum of 4 times per game. Each time you use the clean data action it creates negative points at the end of the game. You should have used more clean data before testing!

4. Calculate test status = dice value + # of Data Tokens on the testing path.

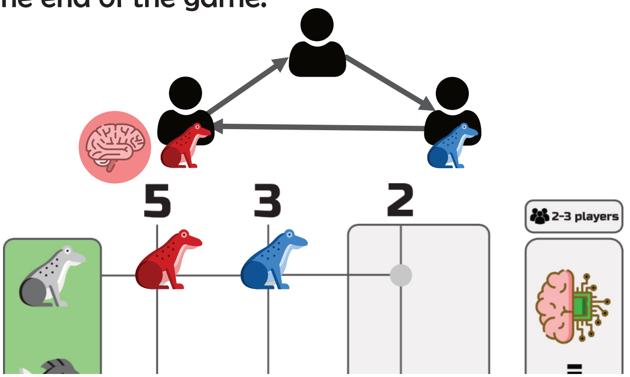
   A test passes with a value of 18 or more.



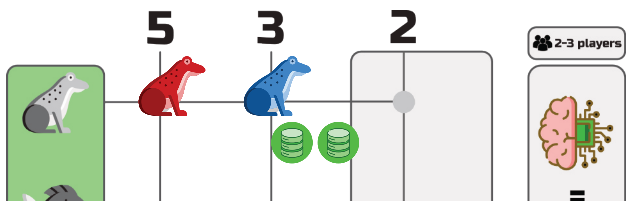
5b. Successful Test: Place the Animal Token on the score board that was tested on the highest available point value on the score board for that animal.

All players that pass a given animal in a round receive the same number of points.

- A round starts with the first player.
- Add Data Tokens next to player(s) animal figures so that all players have the same point value.
- Data Tokens on the scoreboard count as 1 point at the end of the game.



> The blue player just successfully passed the frog test. The red (5 pts) player successfully tested the frog in a previous round, so the blue player takes the 2nd highest value spot for the frog (3 pts).



> The blue player just successfully passed the frog test. The red (5 pts) player successfully tested the frog in the same round, so the blue player takes the 2nd hightest value spot for the frog (3 pts) + two data tokens (2 pts).

Test Model - Learning Actions

5a. Failed Test: Your model learns from its failures, so you have a better chance of success for the next test.

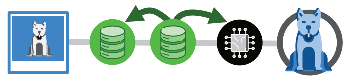
- Model Learns : Must move one, and only one, Data Token on their board . The model learns from its mistakes. This process is called backpropagation, where the weights/bias (refer to page 12) are adjusted to improve future results.
- Refersh Training : May Discard 1 Training or Test Card and new card are replenished.
- The players turn is over.

The moved Data Token does not impact the results of testing for the round, the test failed, as it is only moved after the test status is finalized.

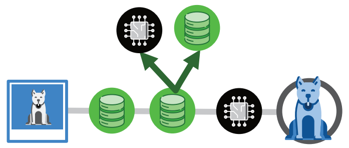
- Skip this step if there are no available Data Tokens on the players board.
- All normal Data Token placement rules apply, unless explicateily stated here.
- A Data Token is not added to the Players' Board.

The path used in the failed test must be involved. The player performs one of the below options: Transfer Move, or Receive Data Tokens.

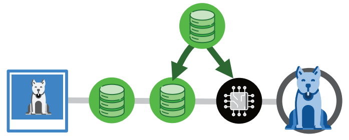
Transfer Data Token within the current test path



Move a Data Token to a node not on the test path



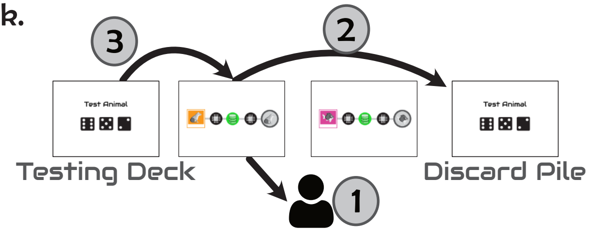
Move a Data Token from a node not on the test path



Changing maxed out Node Tokens:

- If a Data Token is moved from a maxed out Node Token the Overfitting Token is removed.
- If a Data Token is moved to a Node Token and it becomes maxed out, an Overfitting Token must be added immediately.

After all Success or Failed Test actions are complete discarded the Test Card and replace it with a new one from the Training Card deck. If there are no cards in the Test Card Deck, shuffle the discard pile and it becomes the Training Card Deck.



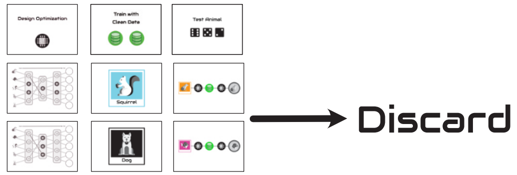
If all players successfully tested the animal indicated on the given Test Card. Remove it from the game and replace with a new Test Card. This ends the players turn.

Refresh

Players can always refresh the market of Design, Training and Test Cards.

Discard Design, Training and/or Test Cards as if the player took these actions and the market is replenished with new cards for the next player.

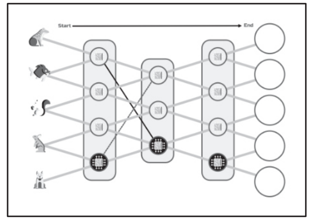
The player may discard any combination of 1-6 cards that were in the center of the table in the market at the beginning of the players turn. They must discard at least 1 card.

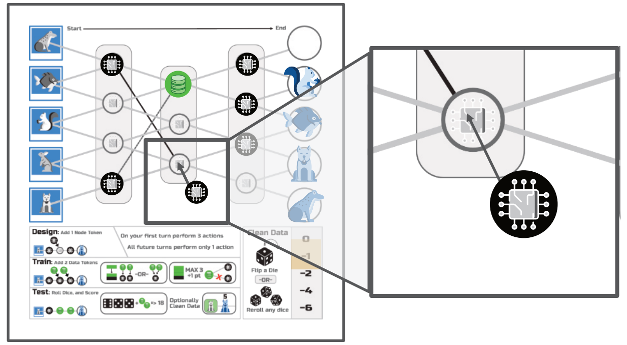


Example Game Play

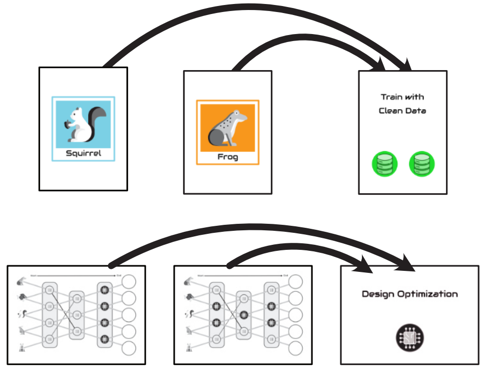
Alex (blue player), is playing a 4 player game. This scenario is during the mid game, so some animals have already been successfully tested for all players. Alex wants to test the dog photo. He will spend 4 turns doing this.

Turn 1 (Design Model) - He needs to spend a turn completing the connection path to the dog.

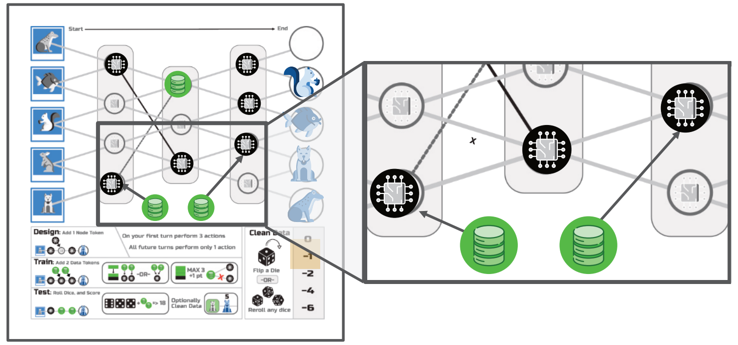




Turn 2 (Refresh Market) - Alex did not like any of the Training or Design Card options in the market, so he decided to discard all of them to hopefully get better options next turn.



Turn 3 (Train Model) - He could do a test now as there is a valid path for the dog photo, but the chances of success is low. He decides to train his model to prepare. This allows him to add two Data Tokens to his model.



Turn 4 (Test Model) - Roll 3 dice and evaluate.

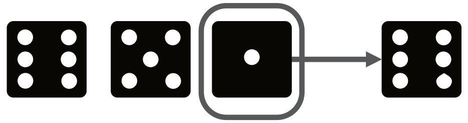
12 ⚅ ⚄ ⚀ + 2 ●● = 14

Currently Failed Test

If Alex does not do anything the test would fail as the test status is below 18.

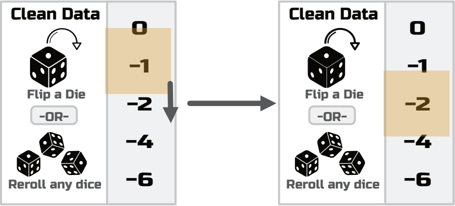
Alex uses the clean data action to flip a die. This will allow him to pass the test this turn, but at a cost.

Flipping Die



Example Gameplay - Continued

He must slide the Clean Data Token down 1 space. Alex will receive a penalty at the end of the game for using the Clean Data action. Instead of receiving -1 point for using the Data Clean action in the earlier sequence, he will receive a penalty of -2 points.



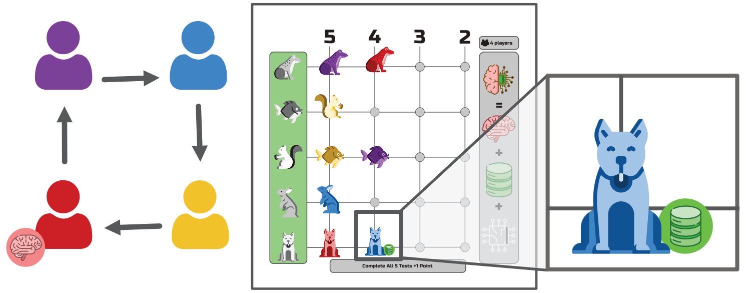
Now the test status is 18+. Alex successfully passed the test this turn.

Die flipped

17 ⚅ ⚄ ⚅ + 2 ●● = 19

Successful Test

The first player is the red player who also successfully passed the dog photo test this round. Both players receive the same number of points. The red player has the first score spot on the scoreboard for dog (5pts). Alex is in second place (4pts) and places 1 Data Token on the Score Board next to his Animal Token to indicate 1 additional point at the end of the game to give him a total of 5 points.

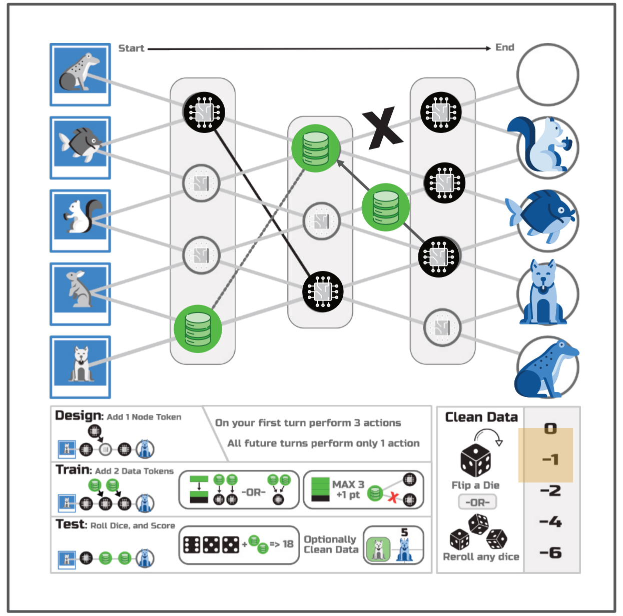


Example Gameplay - Alternate

In an alternate scenario Alex could have chose to NOT use the Clean Data action and Fail the Test.

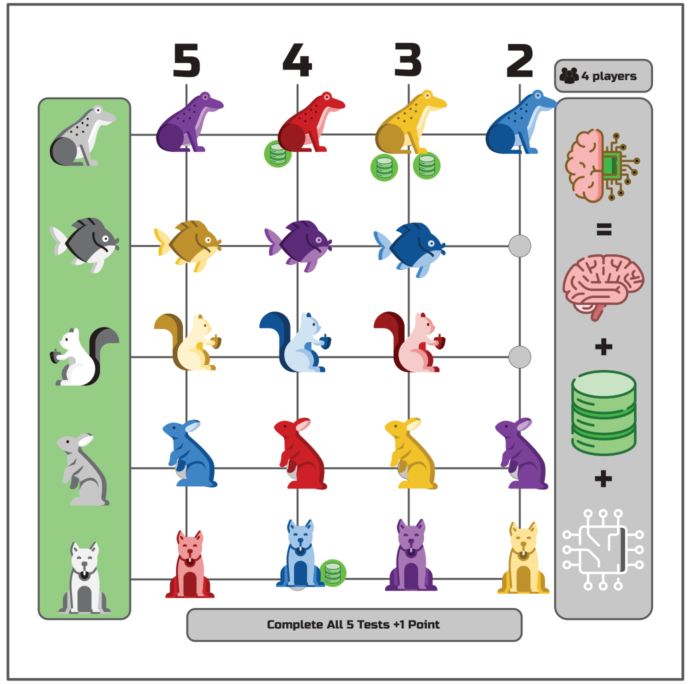
- He must move a Data Token
- He may discard 1 Training or Test Card

Alex moves a Data Token from his dog path to his a new target being Fish, as based on the other players boards he wants to go for Fish before Dog. There are currently 2 training tokens on the target node. This means there is a it is overfitted and a path needs to be blocked.



Alex decides to not discard any card.

End Game Scoring

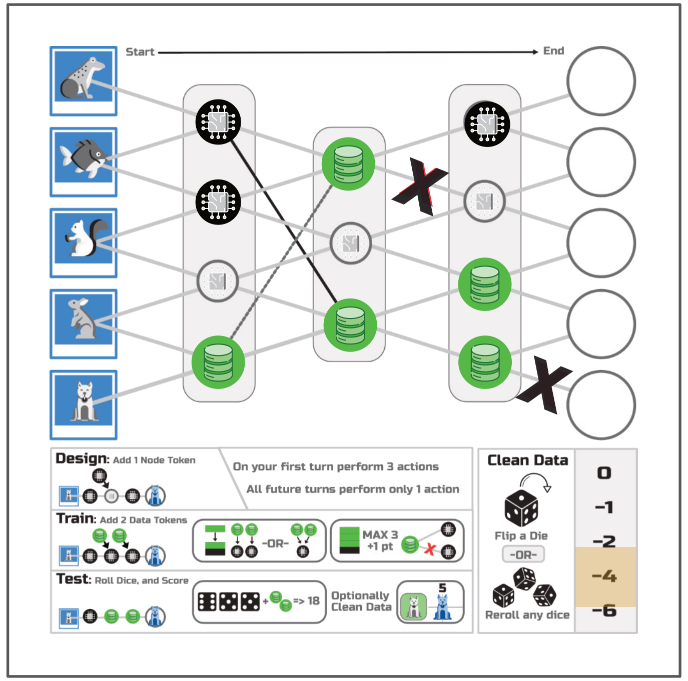


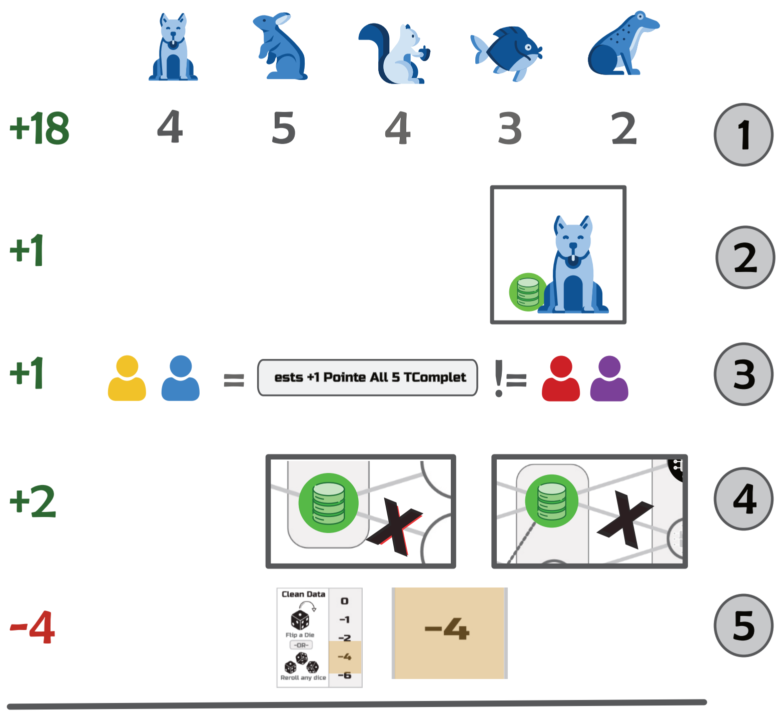
The highest score wins. How to score each player:

1. Each animal scores based on the column it is in. The first spot is 5 points, etc.
2. Any Data Tokens on the Score Board are +1 point.
3. 1 point if all 5 Animal Tokens are on the Score Board.
4. Each maxed node is +1 point on the Players Board.
5. Subtract the points the Clean Data Token is over.

If there is a tie begin analyzing with the first scoring condition to determine a winner. Continue down the list until a winner is identified. If there is still a tie after evaluating each scoring condition , then share the win.

We will use the blue player final state for this example.





Blue Players Final Score 18

Family Mode

If you are looking for an easier game play experience. Do not use the Design, Training or Test Cards during gameplay. Only use th Training and Test Cards during set up. All action rules apply unless explicitly overwritten here.

This is how each action is modified:

- Design : The node tokens can be placed in any empty node slot on the players board.
- Train : The 2 data tokens can be placed on any node token. It does NOT need to be placed on a complete path to animal.
- Test : An animal with a valid complete path can be tested
- Refresh : This action is not possible as there is no market of cards for action selection.

Thank you for playing

Have fun, and learning something along the way

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- Roundicons Premium

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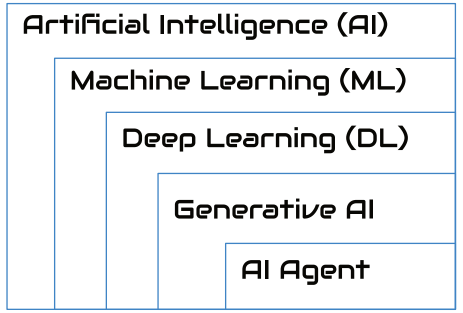
Michael Novack

Learn More

The goal of this section is to give more context to the learning objective of the game. This section is not required to understand to play the game.

People often interchangeably say AI and machine learning are the same thing. All machine learning is AI, but not all AI is machine learning.

AI >> Machine Learning >> Deep Learning >> GenAI >> AI Agent


Artificial Intelligence (AI)
Machine Learning (ML)
Deep Learning (DL)
Generative AI
AI Agent

In this game you create a neural network with multiple layers, which is a type of deep learning.

Deep learning is a type of machine learning (ML) that uses neural networks to learn from data. Neural networks are inspired by the human brain, and they can be used to solve a wide variety of problems, including image recognition, natural language processing, and speech recognition.

Neural networks are the basis for the modern machine learning advancements like Generative AI.

There are two key concepts that are important to understand the strengths and limitations of ML.

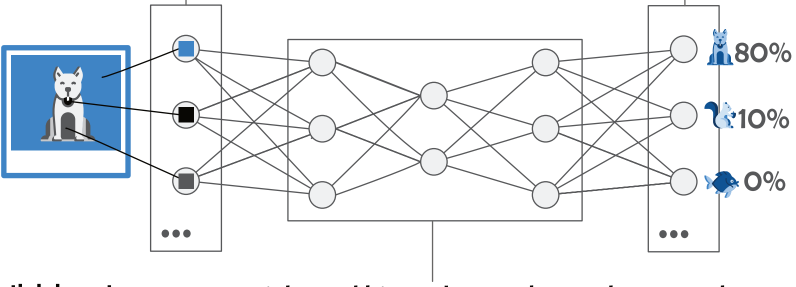
Probability Machine

ML will never be 100% accurate, and that is by design. This is a double-edge sword. It allows us to solve problems that are not possible to address with a rules-based/deterministic method. This is great when you can tolerate some variability in the results of the solution. We often stive for consistency in our systems. Do you want a chance that your mortgage payment goes to the wrong bank? It is about using the right tool for the right job, and ML is not always the best tool for the job.

Data is Destiny

ML needs high quantity and quality data to be effective. Data is the food of ML, as they say you are what you eat. If you only eat fast food, you might have a lot of fuel, but you will not be healthy in the long term. The same thing applies to ML. Getting lots of data is relatively easy. Obtaining quality data is diffcult. Ask yourself is everything on the internet 100% accurate. ML is limited by the data it is provided.

The following is an image of a neural network; notice the similarities to the Player Board. The diagram represents the connections in a neural network.



Input - A node for each pixel in the image

Output - A node for each animal is identified. There is a percent confidence that the photo is of a given animal

Hidden Layers - weight and bias values make up the network That determines how the inputs lead to the outputs.

Each action in the game corresponds to real world actions you would perform to build a neural network.

Design

When you add a Node Token on your Player Board you are deciding the the size and structure of the hidden layers of your model. The more accurate name for a node is actually a neuron. The hidden layers decide how the input into the model will be interrupted and result in a given output. There is a balance between cost and accuracy related to the number of nodes and layers used in a model. The larger the hidden layer space the more accurate it becomes. But, also reflects higher cost it is to train and and added complexity to use.

Train

When you are training the model you are showing it labeled data, so that it can learn from it to make better predictions in the future. This is called supervised learning. Basically you are providing the model a picture of a dog and labeling that picture as a dog. The more samples it has the better it becomes. The training data determines the probability that a given animal will be identified in a picture. The wieght values between nodes and the bias values of each node is calculated to best fit the training data to maximize the accuracy of future predictions. If too much similar data is supplied a model can becom over fitted. If you give the model 80% dog photos it will be inclined to determine that future examples will be dog photos. That scenario is demonstrated in the game by blocked pathways when a given node receives too much training data.

Test

A successful model will accurately identify new images that were not included in the test data photos. Rolling the dice simulates providing a new photo for a specific animal and evaluating if the test is sucessful. As you train the model the likelihood of success increases, but is not guaranteed. This emulates the real world goal of 100% accuracy is no a realistic goal.