

cuacs

Matching Algorithm Overview



**ARCLIGHT ENTERTAINMENT**

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# Introduction

… Animal Client Matching Algortihm (ACM)

**what’s best for the animal** \*if there is a choice between an animal being in an incompatible home or keeping the animal in a shelter, the algorithm will choose to keep the animal until a more suitable match can be found. The animal’s overall happiness and well-being is to be prioritized at all costs.

# Object Model

Since the previous iteration of cuACS, some minor adjustments have been made to our system model, illustrated by the diagram below. The primary change involved merging our ClientTraits and Preferences into a single ClientProfile object, broadly defined as containing all Client attributes outside of basic contact info.

\*Image\*

**Figure** the current Object Model

# Attributes

## List of Attributes

The following attributes are used by the ACM to determine the compatability of any given Animal and Client.

## Comparing Attributes

# Matching Algorithm

The ACM seeks to provide an optimal set of matches by using the compatibility factor for candidates to find the greatest net sum over all of them. There are, however, a few exceptions to this rule that will be elaborated on momentarily. After using the above techniques to determine the compatibility factors of each candidate, they are manipulated by the following four processes to determine the greatest set of matches: Candidate Filter, Heuristics, Production System, and Pruning System.

## Candidate Filter

The Candidate Filter seeks to discard unacceptable matches prior to the Production System performing the bulk of the work. In doing so, it reduces the number of combinations the system has to account for and, resultantly, the size of the graph reduces as well.

The filter takes the candidates and a threshold, say 30% for the purpose of this example. Any candidate found to have a compatibility score lower than this threshold of 30% will be immediately discarded and not considered throughout the rest of the algorithm. This helps to set a hard standard for matches, with the ultimate purpose of preventing Solutions that have a high compatibility average but contain many lackluster matches. This threshold may be adjusted as needed, with higher thresholds yeilding Solutions with lower statistical variance but increasing the chance that some Animals or Clients may be completely excluded from the Solution because their compatibility level was not tolerated by the filter.

## Best-First Search Heuristic

This Heuristic is used to prioritize which Potential Solutions get evaluated first. It assumes that Potential Solutions that contain the most exceptionally compatible candidates are more likely to yeild a better set of matches. For this reason, these Potential Solution paths will be explored first while less desirable matches will be explored later on. This prioritization is what is known as a Best-First Search.

From here, the Production System handles the exploration of Potential Solutions.

## Production System

The Production system reflects the present state of the search and outlines the rules to proceed to the next generation(s) of the system, where each new generation is represented as a node further down on the problem tree. Each node reflects a unique state of the search tree and each new generation a reduction in the problem size. In other words, each generation further approaches a terminating state (base case).

At this point in the algorithm, any subset of the candidates that do not contain the same Animal more than once or the same Client more than once are considered to be Potential Solutions.

Using the Best-First-Search Heuristic describes aboved, the Production System will attempt to evaluate any Potential Solution that has not previously been considered along the search path. The Production System will, upon selecting the next most promising Candidate, pass on Candidates to a new generation of the Production System to evaluate only if they compare neither the selected Candidate’s Animal nor Client.

## Pruning System

While the Heuristic works to prioritizes the evaluation of Potential Solutions that are assumed to be preferable, it does not in isolation reduce the size of the overall problem; that’s where the Pruning System comes in. Any given node in the search tree keeps track of the most most exceptional Solution given the remaining unexplored nodes. Given that optimal subpath the Pruning System considers whether the next unexplored subpath could, given the best-case scenario, provide a more optimal path then that already discovered. If not, then the Pruning System will discard this path before the Production System even has a chance to evaluate it. Using this technique allows the system to reduce the problem size.

# Glossary

Provides a description of key terms used throughout the document.

|  |  |
| --- | --- |
| **Staff (Member)** | Shelter user with access to the Management account. |
| **Client** | Shelter user given a Client profile page by a Staff Member. |
| **Animal** | Shelter animal given an Animal profile page by a Staff Member. |
| **Animal-Client Match (“Match”)** | A pairing of a compatible Animal and Client suggested by the ACM Algorithm. A member of the Solution Set. |
| **Candidate** | A potential but unconfirmed match marked for consideration prior to the execution of the ACM Algorithm. |
| **ACM Algorithm** | Animal Client Matching Algorithm. Suggests a match Solution. This optimization for this solution is determined by a combination of the Search Heuristic, the Production System and the Pruning System. |
|  |  |
| **Solution (Set)** | An optimized list of compatible Matches generated by the ACM. |
| **Potential Solution** | A set of matches that the system has not yet determined to be optimal. |
| **Production System** | How the algorithm determines what subtrees to evaluate. |
| **(Search) Heuristic** | A strategy for arriving at the Solution quicker. |
| **Pruning System** | The system which decides whether a particular search path can be ignored. Ignoring a path guarantees that it could not have yeilded a solution better than any previous solutions found. |