

To run: Install PyKE from <http://pyke.sourceforge.net> and use python3 to run driver.py

An overview of your project, including your motivation for tackling it and how you scoped it.

Our project is a inference based implementation of 20 questions, where the human player picks a person and our system attempts to guess the chosen person by asking the fewest number of questions possible. Given a knowledge base of facts and a set of rules, our driver uses forward chaining to iterate through all the possible ways to describe the people in the knowledge base and then decide the best questions to ask.

Our motivation for our project was we wanted to build something that was both fun to play and that we would learn from building. We initially settled on an electronic version of the game "Guess Who." However, we realized that a game that featured the computer playing a human offered a better opportunity to implement, build and learn about inferences and knowledge representation than a game that had two human playing each other. We originally scoped the project as world leaders so we could have facts relating both to the actual leaders (who the human player would choose) but also nations which gave us a good opportunity for our driver to infer facts about leaders from the nations they lead. Later, we added celebrities and fictional characters to expand the appeal of the game for potential players.

A description of what you built. What reasoner did you use, what knowledge representation resources did you use? What did you get off the shelf, and what did you build?

We settled on the PyKE Python knowledge engine as it fit our project well—it allowed us to define text files of LISP-like facts and rules and then reason about these facts and rules in Python. Python worked well for us as it was easy to use git to collaborate as a group and allowed us to implement an entropy calculator, other decision-tree-like features and collect user answers for our game in Python.

The PyKE engine (<http://pyke.sourceforge.net>) came off the shelf and provided us a reasoning engine, from which we used the forward chaining engine. Our group built the driver which uses the forward chaining engine to iterate through all possible ways to describe the the people in the fact base and calculate the entropy (for each way to describe a person in the fact base, the entropy denotes how close to 50% of the remaining people would a question eliminate) and then asks the best question, given the player's previous answers, the facts and the rules.

Examples of your system in action, including screen shots and real output.

A discussion of how you evaluated your system's performance – what are the relevant measures, and how did your system come out with regard to them?

Is this person male ? (Yes/No) yes
Is this person a world_leader ? (Yes/No) yes
Is this person's official title president ? (Yes/No) yes
Is this person a dictator ? (Yes/No) no
Is this person the ruler/leader of United_States ? (Yes/No) no
The person you are thinking of is Emmanuel_Macron

Note that:

- 1) Male is not a fact in the fact base, the driver inferred it because Macron was not defined as female.
- 2) The 'dictator' attribute is inferred by whether or not the nation had the free_elections attribute or not. If a leader is associated with a nation with free elections, the driver infers that the leader is not a dictator.
- 3) Office title of "president" is inferred if a leader has no other title defined.

Is this person male ? (Yes/No) yes
Is this person a world_leader ? (Yes/No) yes
Is this person a dictator ? (Yes/No) yes
Is this person allies with Xi_Jinping ? (Yes/No) yes
Is this person the ruler/leader of Russia ? (Yes/No) yes
The person you are thinking of is Vladimir_Putin

Note that:

- 1) The "allies with" question comes from nations being defined as allies in the fact base, the driver uses the rules to find leaders that are allied.

Our biggest metrics are: a) does the system figure out the the player's choice in the shortest amount of questions and b) is the system able to reason about new facts about the the people by combining other facts and rules. Our final system was able to fully accomplish both of these goals.

An evaluation of the project itself: What worked well, what didn't work well, and what might you have done differently.

Our system works well in its ability to use the rules to find questions that are better in the sense that they get them to an answer quicker than if it only used the given descriptions of the people in the fact base. So, the system's ability to use forward chaining inference makes the system more efficient at its goal of guessing the people the player chose.

When designing the system we found that we were not able to remove things from the fact base. We would have liked to do that when a player's answer eliminated a number of people from being the correct choice. For example when the system asked the player if the person is a dictator and the player answers no, we would have liked to actually change the fact base and

remove Putin, among others. This was not possible in PyKE so we ended up making a list of eliminated people in our driver and then filtering the results from the forward chainer.

In a parallel universe we would have also made a nicer user interface for the player.