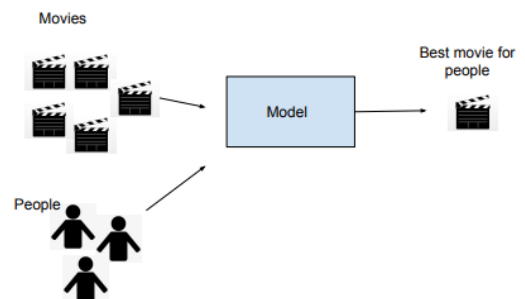


# Project Summary



The goal of this project is to assess the best movie choice a group of people could make, using constraints based on factors related to the potential movie choices and the group. The idea demonstrates the use of a model that is similar to those used for watch recommendations made by platforms such as Netflix and YouTube.

For example, if you want to use our model to find the best movie for three given people our model would do the following. The model will take in key information about the people who wish to watch the movie as well as the pool of movies they have to watch. Our model will then choose a movie from the given pool that best fits the wants of the given people



## Propositions

We have two types of propositions ones for the people we are choosing the movie for and ones for the potential movies to choose from. Each person had three characteristics: their

movie preference, their age, and how much time they have to watch the movie. The movies also have three characteristics: the genre, the age rating, and the length of the movie.

## People propositions

Preference proposition format:

likesRomance<sub>p1</sub> = Person 1 enjoys romantic movies

¬ likesHorror<sub>p1</sub> = Person 1 does not enjoy horror

Propositions involving the other people (person 2, person 3 etc.) and other genres (action, comedy, etc.) will be in the same format. The possible genres are action, horror romance, comedy, and documentary.

## Age proposition format

A17<sub>p1</sub> = Person 1 is at least 17 years old (a = “atleast”)

Propositions involving the other people (person 2, person 3 etc.) and other ages (L13, L17, etc.) will be in the same format.

## Time proposition format

L1h<sub>p1</sub> = Person 1 has less than 1 hour to watch something

Propositions involving the other people (person 2, person 3 etc.) and other availability lengths (L2, L3, etc.) will be in the same format.

## Movie Propositions

### Genre proposition format

$\text{isAction}_{m1}$  = the genre for Movie 1 is Action

Propositions involving the different movies (Movie 2, Movie 3, etc.) and the different genres (action, horror, etc.) will follow the same format. The possible genres are action, horror romance, comedy, and documentary.

### Rating proposition format

$\text{PG13}_{m1}$  = Movie 1 is rated PG-13

Propositions involving the different movies (Movie 2, Movie 3, etc.) and the different age ratings will follow the same format.

### Length proposition format

$\text{ML1}_{m1}$  = Movie 1 is less than 1 hour long

Propositions involving the different movies (Movie 2, Movie 3, etc.) and the different movie lengths will follow the same format.

## Constraints

### Determining age range

$L13 \rightarrow L17$  = if someone is less than 13 years old then they are less than 17 also

All similar constraints dealing age ranges will follow the same format.

### Determining appropriate rating

$L13 \wedge \text{RatedR} \rightarrow \neg \text{AgeAppropriate}$  = if someone is less than 13 years old and the movie is rated R then the movie is not appropriate

Propositions involving the different ages and ratings will follow the same format.

### Determining appropriate genre

$\text{isAction}_{m1} \wedge \text{likesAction}_{p1} \rightarrow \text{likeable}$  = if a movie's genre is action and a person enjoys action then the movie is enjoyable

Propositions involving the different genres and preferences will follow the same format.

### Determining if potential movie is a valid choice:

$\text{likeable} \wedge \text{AgeAppropriate} \wedge \text{enoughTime} \rightarrow \text{valid\_movie}$

## Model Exploration

The first exploration of our model looks to test the functionality of our constraints by creating a basic profiles for a person and using them to see if we can find a solution (best movie match) from 2 hypothetical movies.

#### Person:

age: 17

likes: "romance"

availability: 3 hours

#### Movies:

##### Movie 1:

"name": "movie1"

```
"rating": "PG13"
```

```
"genre": "romance"
```

```
"length": 120
```

**Movie 2:**

```
"name": "movie2"
```

```
"rating": "R"
```

```
"genre": "horror"
```

```
"length": 85
```

The idea in this model is that given a person and a list of movies, we are able to select which movie is the best fit. The model iterates through the person's likes, age bracket and availability, adding propositions to represent them. The model then iterates through the movies, adding propositions that give information about the movie that is relevant to what a person might consider in choosing a movie (i.e. the age rating, genre and length of the movie). The model then looks through the propositions that have been made and uses constraints in order to come up with a suitable movie.

One of the difficulties we encountered in creating this model was finding the right constraints to ensure that the propositions that define the different attributes of the person and movies were correctly connected to the person and movies themselves. We ultimately chose to do this by creating dictionaries of values storing each movie and the person, and comparing the values found in the dictionaries to the value that each specific proposition defined. This gave us a method of computing which propositions *should* be defined as True, however there were a few different methods in which assigning Boolean values could hypothetically be done. We decided that if they matched, we would assign the proposition a True value using **constraint.add\_exactly\_one**. The rest of the propositions that defined the information found in the person and movie dictionaries, but didn't directly match a value in the dictionaries was assigned a Boolean value depending on which of the propositions had been evaluated to true in the previous step.

This model exploration prompted us to make some changes in our model going forward. For example, our previous propositions for a person's availability had been defined as being either greater or less than a certain number of hours. In implementing this model, we found that representing amounts of time in this way was redundant. We also wanted to be specific about how long a movie was (in minutes) when we defined them in the dictionaries,

since that data is easily accessible and would be easy to convert into a Boolean value for a proposition. However, we could only do this accurately if we defined these propositions in terms of blocks of time (i.e: less than and hour, between 1 and 2 hours, etc.). This lead us to changing our propositions.

## Jape Proof Ideas

A represents is\_L13

B represents is\_L17

1: **A,  $A \rightarrow B$**  premises

2: **B**  $\rightarrow$  elim 1.2,1.1

A represents is\_L13

B represents is rated\_R

C age\_appropriate

1: **A, B,  $A \wedge B \rightarrow \neg C$**  premises

2:  **$A \wedge B$**   $\wedge$  intro 1.1,1.2

3:  **$\neg C$**   $\rightarrow$  elim 1.3,2

A represents is\_action m1

B represents enjoys\_action p1

C represents enjoyable

1: **A, B,  $A \wedge B, A \wedge B \rightarrow C$**  premises

2:  **$A \wedge B$**   $\wedge$  intro 1.1,1.2

3: **C**  $\rightarrow$  elim 1.4,2

A represents likeable

B represents age\_apropriate

C represents enough\_time

D represents valid\_movie

- 1:  $A, B, C, A \wedge B \wedge C, A \wedge B \wedge C \rightarrow D$  premises
- 2:  $A \wedge B$   $\wedge$  intro 1.1,1.2
- 3:  $A \wedge B \wedge C$   $\wedge$  intro 2,1.3
- 4:  $D$   $\rightarrow$  elim 1.5,3

## First-Order Extension

These will mirror closely to the propositions defined above. We have objects in the first-order setting that correspond to people and movies. These objects have predicates describing their characteristics.

### Propositions

#### People propositions

$p_1 = \text{Person 1}$  (Format holds for other people )

#### Preference propositions

$EA(p_1)$  = Person 1 enjoys action movies  
 $\neg EH(p_1)$  = Person 1 does not enjoy horror movies

#### Age proposition format

$A17(p_1)$  = Person 1 is at least 17 years old

#### Time proposition format

$L1h(p_1)$  = Person 1 has less than 1 hour to watch something

#### Movie propositions

$m_1 = \text{movie 1}$  (Format holds for other movies )

#### Genre proposition format

$A(m_1)$  = the genre for Movie 1 is action

### Rating proposition format

**PG13(m<sub>1</sub>)** = Movie 1 is rated PG-13

### Length proposition format

**L1(m<sub>1</sub>)** = Movie 1 is less than 1 hour long

### Suitability proposition format

**S(m<sub>1</sub>)** = Movie 1 is suitable

## Constraints

### Determining age range

**$\forall x( L13(x) \rightarrow L17(x) )$**

Interpretation: if anyone is less than 13 years old then they are also less than 17 years old

### Determining appropriate rating

**$\forall x \forall y( L13(x) \wedge R(y) \rightarrow \neg AA(y) )$**

Interpretation: if anyone is less than 13 and any movie is rated R then the movie is not age appropriate

### Determining appropriate genre

**$\forall y \forall x( A(y) \wedge EA(x) \rightarrow E(x, y) )$**

Interpretation: if anyone in joys action movies and any movie is an action movie then that person will enjoy that movie