Under the hood
Exploration, Translation,
Survey AI applications and Near-Term Predictions
Lookahead (projecting into the future)

Current Situation

Swerve (your) right

Continue

Swerve left

Thought Horizon of an AI must be limited

Swerve (your) right:
- Two jump (their) right:
  - Other objects
    - Status quo
      - Expected cost = 47
      - 10 dead (Pr = 0.7)

Swerve left:
- Three jump (their) left:
  - Other objects
    - Status quo
      - Expected cost = 112
      - 10 dead
  - Child emerges from behind adult
    - Expected cost = 136
    - 4 dead

Two jump:
- Two jump:
  - Other objects
    - Status quo
      - Expected cost = 136
      - 4 dead
Illustrating an AI algorithm, a non-AI algorithm, and a ML algorithm

Google Directions is an AI (optimization) algorithm:
it explores many route options and returns the best few

AI: exploration

Actually following a single route is a non-AI (deterministic) algorithm

Doug selected the bottom route and changed it to swing closer to Fall Creek Falls State Park.

I can select and modify a route: this is human-computer interaction
In fact, Doug more often than not chooses routes that swing close to state and national parks. I will start favoring routes that swing past wilderness parks when searching for Doug – this is Machine Learning!
Adding flexibility to an inflexible (aka deterministic) algorithm

The algorithm will evaluate likelihood that original route is intended and likelihood that new route is intended (What is user intent?)
Game AI
Clearly about exploring alternatives

http://chesstroid.blogspot.com/2014/03/how-deep-can-brute-force-dive.html
https://www.flickr.com/photos/amitrajit/5356032927
Translation is about exploring alternatives too

There will be multiple translations for even the simplest of sentences.
Translation is about exploring alternatives too

I saw her duck
- Ich habe ihre Ente gesehen

I saw her duck swimming
- Ich sah ihre Ente schwimmen

I saw her duck the flying debris
- Ich habe gesehen, wie die fliegenden Trümmer enteuchte

I saw her dehumidify the flying debris
- Ich habe gesehen, wie die fliegenden Trümmer enteuchte

I saw her duck the flying bat
- Ich habe gesehen, wie die Fledermaus duckte

Her team was on the field. She threw a fastball and the batter hit a line drive right towards the mound. I saw her duck.

Ihr Team war auf dem Feld. Sie warf einen Fastball und der Teig traf eine Linie rechts in Richtung des Hügels. Ich habe ihre Ente gesehen.
The spirit is strong but the flesh is weak

精神は強いが肉は弱い

Spirit is strong but meat is weak

Surgery is bad, but it is weak

The spirit is strong but the body is weak

精神は強いが体は弱い
Exploitation Exploration Tradeoff

This came up in discussion on story telling: small variations on the same successful ‘formula’ over and over, or out of the box with the possibility of ‘failure’
Interactive Narrative

- Façade: [http://www.interactivestory.net/](http://www.interactivestory.net/) (play trailer)

- Vonnegut’s graphing of stories: [https://www.youtube.com/watch?v=oP3c1h8v2ZQ](https://www.youtube.com/watch?v=oP3c1h8v2ZQ)


![Diagram of narrative trajectories](image)

Passing through region C is a poor experience

Passing through Region A then B is a good experience

Experience manager determines narrative trajectory

Experience manager adjusts to user actions

User and NPCs act as they want

Figure 1. The Experience Management Problem Is to Compute Trajectories through State Space.

a. A possible narrative trajectory through state space. b. A possible narrative trajectory that visits states deemed favorable and avoids states deemed unfavorable. c. Accounting for player interaction.

Strong Autonomy

Strong Story
Prepping for TA-w4
Recommender Systems
Personalized

A decision tree that predicts Doug’s movie preferences

Back in the day
Decision tree classifiers

[ SciFi = -1, Suspense = 1, Romance = -1, Ebert = 1, Siskel = 1, ..., Rent-it???

\[
\begin{align*}
\text{SciFi} & \quad \text{Ebert} \\
-1 & \quad 1 \\
-1 & \quad 1 \\
\sim\text{Rent-it} & \quad \text{BigStar} \\
(-1) & \quad -1 \\
\sim\text{Rent-it} & \quad \text{Rent-it} \\
(1) & \quad 1 \\
\sim\text{Rent-it} & \quad \sim\text{Rent-it} \\
& \quad \sim\text{Rent-it} \\
& \quad \text{Rent-it} \\
& \quad \text{Rent-it} \\
& \quad \text{Rent-it} \\
& \quad \text{B\&W} \\
& \quad -1 \\
& \quad 1 \\
& \quad \sim\text{Rent-it} \\
& \quad \text{Rent-it}
\end{align*}
\]
Decision tree classifiers

[ SciFi = -1, Suspense = 1, Romance = -1, Ebert = 1, Siskel = 1, ..., Rent-it???

```
SciFi
-1

~Rent-it
(-1)

BigStar
1

Rent-it
(1)

~Rent-it

```

```
Ebert
1

```

```
Siskel

```

```
Romance

```

```
Rent-it

```

```
B&W

```

```
~Rent-it

```

```
Rent-it

```
Decision tree classifiers

[ SciFi = -1, Suspense = 1, Romance = -1, Ebert = 1, Siskel = 1, ..., Rent-it?? ]
Decision tree classifiers

[SciFi = -1, Suspense = 1, Romance = -1, Ebert = 1, Siskel = 1, ..., Rent-it??]
Decision tree classifiers

[SciFi = -1, Suspense = 1, Romance = -1, Ebert = 1, Siskel = 1, ..., Rent-it??]

rent-it
Consider a completely new movie description, with a different value for Romance (and Suspense); I have also shown the value for B&W

$$\begin{align*}
\text{SciFi} &= -1, \\
\text{Suspense} &= -1, \\
\text{Romance} &= -1, \\
\text{Ebert} &= 1, \\
\text{Siskel} &= 1, \\
\text{B&W} &= -1, \\
\text{Rent-it} &= \text{???} \end{align*}$$
The values for Romance and B&W of this new datum would lead to a different classification than the previous datum:

\[
\text{SciFi} = -1, \quad \text{Suspense} = -1, \quad \text{Romance} = -1, \quad \text{Ebert} = 1, \quad \text{Siskel} = 1, \quad \text{B&W} = -1, \ldots, \quad \text{Rent-it???}
\]
What decision would be made for the following datum, Rent-it or ~Rent-it?

[SciFi = 1, Suspense = 1, Romance = -1, Ebert = -1, Siskel = 1, BigStar = 1, ..., Rent-it??]

Douglas H. Fisher
[SciFi = 1, Suspense = 1, Romance = -1, Ebert = -1, Siskel = 1, BigStar = 1, ..., Rent-it??]

Douglas H. Fisher