Overview

• Recap activity
• “AI Hard” problems
• Three big challenges
Recap activity (part 1)

• One useful / interesting thing you **learned**

• One thing you wish we’d **done differently**

• One **lingering question** you still have
Recap activity (part 2)
Discussion

What kinds of problems have we been successful at solving using ML?
“AI Complete” problems
Bongard problems

- Russian computer scientist M. M. Bongard (1924 – 1971)
- **Big idea**: *pattern recognition* (esp. visual) is the foundation of mental processing
- *The Problem of Recognition* (1967) contained 100 visual puzzles as an appendix
Bongard problems

- kink **between** the loops
- loops on the **same side** of kink
- single-stroke diagrams with two loops and one kink
## Bongard problems

<table>
<thead>
<tr>
<th>Follow the rule</th>
<th>Don’t follow the rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>53</td>
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<td>12</td>
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<td>68</td>
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<td>29</td>
<td>37</td>
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</tbody>
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2-digit numbers

sum of digits is **odd**

sum of digits is **even**
Discussion

What makes these problems hard?
Machine translation

Source Language

TRANSLATE

Destination Language
“Y así, del poco dormir y del mucho leer, se le secó el cerebro, de manera que vino a perder el juicio.”

- Miguel de Cervantes

“And so, of the little to sleep and of the a lot to read, he it dried the brain, of way what came to lose the judgment.”

- Google Translate (word by word)
“Y así, del poco dormir y del mucho leer, se le secó el cerebro, de manera que vino a perder el juicio.”

- Miguel de Cervantes

“And so, of the little sleep and of much reading, his brain dried up, so he came to lose his mind.”

- Google Translate
“Y así, del poco dormir y del mucho leer, se le secó el cerebro, de manera que vino a perder el juicio.”

- Miguel de Cervantes

“Finally, from so little sleeping and so much reading, his brain dried up and he went completely out of his mind.”

- Samuel Putnam
What makes this problem hard?
Computer vision

- Object recognition
- Motion tracking
- Follow the segmentation
Image segmentation
Image segmentation
Image segmentation
Image segmentation
Discussion

What makes this problem hard?
Big Challenges
Challenge 1: data scale

How many observations did your models need to train on?
Challenge 2: specific tasks
Challenge 3: opaque learning process

INPUT: Image broken into pixels

Layer 1: Pixel values detected

L2: Edges identified

L3: Combinations of edges identified

L4: Features identified

L5: Combinations of features identified

OUTPUT: “Dog”

Image courtesy Lucy Reading-Ikkanda / Quanta Magazine
Challenge 3: opaque learning process
Challenge 3: opaque learning process
In closing

- Understand what ML is (and isn’t)
- Learned some foundational methods / tools
- Able to choose methods that make sense
Thanks for a great semester!

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