In our own image:

the new artificial intelligence

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Metropolis
Fritz Lang, 1927
The first computers...
Alan Turing

Enigma Machine
The Colossus
Bletchley Park, 1944
Is the human brain a computer?
• CPU and memory are separate

• the processor is very fast

• serial operation

• very reliable parts; but the whole computer may break easily

• the memory and CPU are the same

• the parts (neurons) are very slow

• parallel; enormous interconnectivity

• unreliable parts; but the whole brain is very reliable
Things digital computers do well

- Numeric computation
- Symbolic computation
- Repetitive operations
- Follow instructions

Things human brains do well

- Find subtle patterns (intuition?)
- Find novel solutions by analogy
- Learn
What is a neural network?
Learning vs. Programming
<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>→ 4</td>
</tr>
<tr>
<td>5</td>
<td>→ 25</td>
</tr>
<tr>
<td>3</td>
<td>→ 9</td>
</tr>
<tr>
<td>11</td>
<td>→ 121</td>
</tr>
<tr>
<td>13</td>
<td>→ ?</td>
</tr>
<tr>
<td>Input</td>
<td>Output</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>fever, runny nose, muscle ache</td>
<td>flu</td>
</tr>
<tr>
<td>no fever, runny nose</td>
<td>allergies</td>
</tr>
<tr>
<td>no fever, skin rash infection</td>
<td>staphylococcus</td>
</tr>
<tr>
<td>\textit{fever, runny nose}</td>
<td>?</td>
</tr>
</tbody>
</table>
“The Voringian binx glorphed the Knappoboor”
My grandmother lives near us.
"I like to go to my grandmother’s house. Well… because she gives us candy. Well … and we eat there sometimes. Sometimes we sleep overnight there. Sometime when I got to go to my cousin’s …"
Simple Recurrent Network

INPUT LAYER

HIDDEN LAYER

OUTPUT LAYER

CONTEXT LAYER
Simple Recurrent Network
The importance of starting small
First results:

Nothing worked!
Early stages: learn the simpler things first;

Later stages: this makes it easier to learn the more complex things later
How far can we go? Can a machine ever be like a human?

How far *should* we go...?