



EEL5840: Elements of Machine Intelligence

Subjugator 2006

Announcements



- Today's Handouts (see website):
 - > Outline Class 4
 - > LISP Notes 1
- Web Site
 - > www.mil.ufl.edu/5840
 - > Software and Notes
- Reading Assignment:
 - > Nilsson Chapter 3
 - > LISP Chapters 1-5
- Written Assignment Reminder
 - > Homework 1 due Tue. 8/30 in class
 - > Homework 2 due Tue. 9/03 in class



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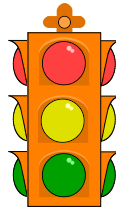
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Today's Menu

- Example of a Classical AI Production System
{See slides 15-22 from class #3}
 - > Irrevocable Control Strategy
 - > Tentative Control Strategy
- Architectures for the Implementation of Action Functions
 - > B. State Machines
 - > C. Artificial Neural Networks
 - > D. Subsumption Architecture
- Final Thoughts on Stimulus-Response (SR) Agents - Chapter 2



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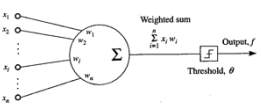
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Perception and Action

- **State Machines:** Implementation of Boolean (action) functions using a connected network of logical gates AND, OR, NOR, etc.)
- **Networks:** Implementation of action functions using a connected network of threshold units or other elements that compute a nonlinear function of a weighted sum of their inputs. One such element is the *threshold logic unit* or TLU for short.



Boolean functions implementable by a TLU are called *linearly-separable functions*. (A TLU separates the space of input vectors into an above-threshold response from below-threshold response by a linear surface—called a *hyperplane* in n dimensions.)

Not all Boolean functions are linearly separable—however a monomial or any clause is linearly separable.

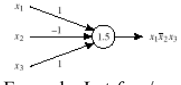
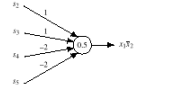
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Perception and Action

Example: Let $f = x_1/x_2x_3$

x_1/x_2x_3	f	\sum	TLU
000	0	0	0
001	0	1	0
010	0	-1	0
011	0	0	0
100	0	1	0
101	1	2	1
110	0	0	0
111	0	1	0

Example: Let $b-f_4 = x_1/x_2$
 $= (s_2+s_3)/(s_4+s_5) = (s_2+s_3)/s_4/s_5$

$s_2 s_3 / s_4 / s_5$	$b-f$	\sum	TLU	$s_2 s_3 / s_4 / s_5$	$b-f$	\sum	TLU
0000	0	0	0	1000	1	1	1
0001	0	-2	0	1001	0	-1	0
0010	0	-2	0	1010	0	-1	0
0011	0	-4	0	1011	0	-3	0
0100	1	1	1	1100	1	2	1
0101	0	-1	0	1101	0	0	0
0110	0	-1	0	1110	0	0	0
0111	0	-3	0	1111	0	-2	0

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Perception and Action

- The Subsumption Architecture
 - > An agent's behavior is controlled by a number of "behavior modules." Each module receives sensory information directly from the world. If the sensory inputs satisfy a precondition specific to that module, then a certain behavior, also specific to that module, is executed. One behavior module can subsume another.
 - > As contrasted with much other work in AI, these machines do not depend on complex internal representations of their environments or on reasoning about them.

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Neural Networks

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graph LR; TD[Training Data] --> AM[Adjustable Model]; TA[Training Algorithm] --> AM; AM --> CP[Continuous FA Classifications Predictions]
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- Neural Networks (also known as Artificial Neural Networks or ANNs for short)
 - You need this framework to model processes that cannot be represented as analytical models, e.g., human actions, computer vision, non-linear control, the stock market...

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The End!

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