Spectrum Curricula for Measuring Teachability

Jacob Beal, Alice Leung, Robert Laddaga
ALIHT @ AAMAS 2010
Goal: Informal Learning

- Humans teach one another informally
- Teacher & student adapt to one another
- How can we quantify student teachability?
Spectrum Curriculum

- Pick one dimension to focus on
- Sequence of lessons along dimension
  - Incrementally move from hard to easy
- Test before first lesson, after each lesson

![Graph showing performance over lessons with different learning trajectories: little learning, progressive improvement, confusion from over-simplifying, and non-adaptive machine learning.](image)
Instructional Framework

- Scripted curriculum
- Agents exchange symbolic messages:

```
Student   messages   Teacher

percepts  actions   percepts
```

Implemented by BAE for DARPA BL program
BBN RoboCup Keepaway Curricula

- 3-on-2 KeepAway in standard RoboCup simulator
- Base player with gaps for learning 7 binary strategic decisions
## Seven Curricula:

<table>
<thead>
<tr>
<th>Curriculum</th>
<th>Spectrum</th>
<th>Modality</th>
<th>Side</th>
<th>Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out of Bounds</td>
<td>Mutual Assumptions</td>
<td>Examples</td>
<td>Both</td>
<td>7</td>
</tr>
<tr>
<td>Where to guard</td>
<td>Mutual Assumptions</td>
<td>Examples</td>
<td>Taker</td>
<td>6</td>
</tr>
<tr>
<td>Where to pass</td>
<td>Transfer Distance</td>
<td>Examples</td>
<td>Keeper</td>
<td>6</td>
</tr>
<tr>
<td>Who to guard</td>
<td>Transfer Distance</td>
<td>Examples</td>
<td>Taker</td>
<td>6</td>
</tr>
<tr>
<td>Where to move</td>
<td>Transfer Distance</td>
<td>Feedback &amp; Examples</td>
<td>Keeper</td>
<td>8</td>
</tr>
<tr>
<td>Guard vs. take</td>
<td>Detail of Instruction</td>
<td>Telling &amp; Examples</td>
<td>Taker</td>
<td>7</td>
</tr>
<tr>
<td>When to pass</td>
<td>Detail of Instruction</td>
<td>Telling &amp; Feedback</td>
<td>Keeper</td>
<td>10</td>
</tr>
</tbody>
</table>
Example: Guard or Take?

- Example only

GoTake(T1) = True
GoTake(T0) = False
Example: Guard or Take?

- Example only
- Hint: ball position

GoTake(T1) = True
GoTake(T0) = False
Example: Guard or Take?

- Example only
- Hint: ball position
- Hint: distance fn

GoTake(T1) = True
GoTake(T0) = False
Example: Guard or Take?

- Example only
- Hint: ball position
- Hint: distance fn
- Hint: distance(?,ball)

GoTake(T1) = True
GoTake(T0) = False
Example: Guard or Take?

- Example only
- Hint: ball position
- Hint: distance fn
- Hint: distance(?,ball)
- Hint: distance(T1,ball)

GoTake(T1) = True
GoTake(T0) = False
Example: Guard or Take?

- Example only
- Hint: ball position
- Hint: distance fn
- Hint: distance(?,ball)
- Hint: distance(T1,ball)
- Hint: both distance function calls

GoTake(T1) = True
GoTake(T0) = False
Example: Guard or Take?

- Example only
- Hint: ball position
- Hint: distance fn
- Hint: distance(?,ball)
- Hint: distance(T1,ball)
- Hint: both distance function calls
- \( \text{Distance(me.pos,ball,pos)} < \text{Distance(other.pos,ball.pos)} \)

\( \text{GoTake}(T1) = \text{True} \)
\( \text{GoTake}(T0) = \text{False} \)
Gathering Human Baseline

Froomb!

- JavaScript web app displays human-equivalent curricula, gathering anonymous results
Contributions

- Spectrum curricula measure learner adaptivity
- Designed seven RoboCup spectrum curricula
- Validating concept by gathering human baseline
Participate!

http://dsl.bbn.com/BL/

- Take tests to help build a human baseline
- Download curricula to test your work against
- Contribute your own curricula