ANALYSIS OF CURLING TEAM STRATEGY/TACTICS USING CURLING INFORMATICS

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INTRODUCTION

• Japan national curling team won Second place at the Woman’s World Championship 2016
  → Still need to continue working in order to aim for the top

• Curling is an Olympic game
  → Fifth place at the Sochi Winter Olympics
  → Japan needs to work its way to get the medal
The tactical aspects of curling play are still very, very important.
– John R. Bradley

**Physical factor**
- Temperature of ice sheet
- Changes in ice sheet
- Characteristics of stone
- Behavior of stone

**Human factor**
- Player’s skills
- Player’s physical abilities
- Player’s state of health
- Player’s state of mind

**Strategic/Tactical factor**
- Shot type
- Shot accuracy
- Game plan
- Team strategy/tactics

“The tactical aspects of curling play are still very, very important.
– John R. Bradley
CURLING INFORMATICS

Cloud Servers
- Real time information analysis
- Integration of game information
- Search and Reference
- Inference of tactics

Network communication

Recording/Reference Game Information

Tactical navigation

Reflection and tactical training
PORTABLE DIGITAL SCORE BOOK

*iCE* (intelligent Curling Elicitator)

- Recording a game information in real time
- Showing shot accuracies for each team

CURLING INFORMATICS

Objective analysis of the game information

Cloud Servers
- Real time information analysis
- Integration of game information
- Search and Reference
- Inference of tactics

Recording/Reference Game Information
Tactical navigation
Reflection and tactical training
Goal of this research

To support tactical factors of top curling teams and improve the strategic and tactical skills of curling players

Aim to specify the team’s characteristics and establish the appropriate analytical method

This paper

Discuss the influence of shot accuracy on the game result
BACKGROUND
CURLING?
CHESS ON ICE

produced by Curling Canada
We have gotten consent to use this video from Curling Canada.
SHOT SCORE

- Shot score is rating how accurate the delivered shot was according to the team skip from 0 to 4 points.
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Shot Accuracy = \( \frac{\text{Total Shot-Scores}}{\text{Number of Shots}} \times 25 \text{%} \)

- Shot score is rating how accurate the delivered shot was according to the team skip from 0 to 4 points.
METHOD AND TARGET DATA
METHOD

Calculate correlation

Difference in shot accuracy
95 - 76 = 19 Point

Calculate correlation

Difference in game score
9 - 3 = 6
TARGET DATA

Total of 378 games, covering around sixty thousand shots

<table>
<thead>
<tr>
<th>Year</th>
<th>Championships</th>
<th>Number of games</th>
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<tbody>
<tr>
<td>2012</td>
<td>30th Japan Championship</td>
<td>26</td>
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<tr>
<td></td>
<td>PACC Japan Playoff</td>
<td>16</td>
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<tr>
<td></td>
<td>Pacific Asia Junior Championship</td>
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<td></td>
<td>World Junior Championship</td>
<td>11</td>
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<td></td>
<td>3th College Championship</td>
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<td></td>
<td>Universiade 2013 of Japan Playoff</td>
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<tr>
<td>2013</td>
<td>Japan Junior Championship</td>
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<td>31th Japan Championship</td>
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<td></td>
<td>Olympic Winter Game of Japan Playoff</td>
<td>21</td>
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<tr>
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<td>4th College Championship</td>
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<td>Universiade 2015 of Japan Playoff</td>
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<td></td>
<td>Advics Cup</td>
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<tr>
<td></td>
<td>Sochi Olympic Winter Game</td>
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<tr>
<td>2015</td>
<td>World Woman’s Championship</td>
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</table>
ANALYSIS PROCEDURE

- Record of game information
- Extraction of game scores (GS)
- Extraction of shot accuracies (SA)

Game Information Database

Calculation of the difference in SA and difference in GS

Calculation of the Pearson correlation coefficient

Detection of Outliers

Analysis of game information as Outliers
ANALYSIS BY MASUI 2016

- Difference in shot accuracies is related to the difference in the game scores

- Japanese national class has stronger correlation than Japanese Jr class

- In World class the correlation becomes weaker than for Japanese national class

RESULT AND DISCUSSION
ANALYSIS OF SOCHI WINTER OLYMPICS

MEN

WOMEN

\[ R = 0.63 \]

\[ 0.7 > |R| > 0.5 \]

\[ R = 0.67 \]

\[ 0.7 > |R| > 0.5 \]
SOCHI WINTER OLYMPICS BEST4

Difference in game scores

Difference in shot accuracies

R = 0.59

0.7 > |R| > 0.5
ANALYSIS OF SOCHI WINTER OLYMPICS

Team shot accuracies: **High**
Correlation between the two differences: **Low**

⇒ **Another factor influences game result**
WHY CORRELATION DECREASES?

Difference in game scores

Difference in shot accuracies
How do tactics or strategies affect game result?

→ Analyzed games in which the team of superior shot accuracy lost due to failure in tactics
ANALYZING GAMES OF OUTLIERS

Shot accuracy

<table>
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<tr>
<th>Team</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>7</td>
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<tr>
<td>B</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>5</td>
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</tbody>
</table>

Team A Total: 7
Team B Total: 5

Team A: Green
Team B: Orange
Takeouts: Triangle
Draws: Diamond
RATIO OF SHOTS PERFORMED BY EACH TEAM

Team A
- Draw shots: 36%
- Takeout shots: 64%

Team B
- Draw shots: 49%
- Takeout shots: 51%
EFFECT OF SHOT

**Draw shots**
Raise the score probability of one’s own team

**Takeout shots**
Reduce the score probability of opponent team
ANALYZING GAMES OF OUTLIERS

- Team A performed many **takeout shots**
  → Used the tactics of risk evasion as their priority
- Effectively taking advantage of missed shots performed by team B
ANALYZING GAMES OF OUTLIERS ②

Takeout shots: 64%
Draw shots: 36%

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<th>F</th>
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<tbody>
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<td>1</td>
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<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>X</td>
</tr>
</tbody>
</table>

End 30
One missed shot can influence match situation.
How do tactics or strategies affect game result?

- Analyzed games in which the team of superior shot accuracy lost due to failure in tactics

Winning team took the tactics of risk minimization

The selected tactics and pressure for opponent influenced game result
CONCLUSIONS

- Analyzed game information of a number of curling matches by using \textit{iCE}
  \rightarrow Difference in shot accuracies is related to the difference in game scores

- Analyzed game information of outliers from tactical point of view
  \rightarrow Selected tactics and pressure on opponent team had an impact on game result
FUTURE WORK

- Continue analyzing game information of outliers from tactical point of view
  → Extract characteristics from games of outliers

- Aim to support the Japanese national team in the Winter Olympic games in 2018