Automated Grading, Upgrading, and Cuttings Prediction of Surfaced Dry Hardwood Lumber

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Why conduct the hardwood lumber scanning R&D?
• A major sawmill owner said on scanning and grading lumber... things will change the minute we can have a machine to accurately grade the product (lumber) and bar code it and designate a best application... molding, furniture, flooring or whatever...

Our most recent efforts deal with testing of a system to Automate Hardwood Lumber Grading and Predict Cuttings or Uses

We simulate cutting yields and best lumber uses with ROMI software

Motivation
• Hardwood sawmills:
  • They have limited NHLA graders and need to reduce costs and improve marketing
• Lumber purchasers:
  • Need to grade lumber to validate purchases
  • Need to best utilize lumber
  • Need to reduce costs

Current study
• Our prototype scanning system
  • Designed for rough or surfaced lumber
  • Scans boards using lasers, video camera, PC
  • Detects wane, clear wood, defects
  • Interfaces with E/T and grading software
  • ROMI software used to predict cuttings
  • Focus on hardwood
  • Defect types: wane, holes, decay, knots, voids/splits

Example images

Detecting wane and defects

Experimental results from poplar and red oak boards

Lumber grading results from the company grading and our automated system

<table>
<thead>
<tr>
<th>Species</th>
<th>Company</th>
<th>Grade</th>
<th>No. of Boards</th>
<th>Same Grade</th>
<th>Higher Grade</th>
<th>Lower Grade</th>
<th>Upgrade Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>FAS</td>
<td>1C</td>
<td>36</td>
<td>17</td>
<td>0</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Poplar</td>
<td>2C</td>
<td>21</td>
<td>14</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>2C</td>
<td>27</td>
<td>22</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Oak</td>
<td>1C</td>
<td>39</td>
<td>14</td>
<td>24</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2C</td>
<td>24</td>
<td>18</td>
<td>5</td>
<td>3</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>86</td>
<td>33</td>
<td>10</td>
<td>44</td>
<td>37</td>
</tr>
</tbody>
</table>

Lumber Grading -- Red Oak -- Grade 2C

ROMI simulations -- Red Oak -- Grade 2C

Summary
• Our scanning does a nice job on KD surfaced lumber
• NHLA hardwood lumber grading has been demonstrated
• (We are rechecking the grades and adding more scanned boards)
• ROMI simulated cuttings can be determined
• Best lumber use determination is possible