A.I. in Healthcare, Making it Matter

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17 years
What exactly is artificial intelligence?
How artificial intelligence is revolutionizing healthcare

by BEN DICKSON — 13 days ago in ARTIFICIAL INTELLIGENCE

Technology Will Replace Many Doctors, Lawyers, and Other Professionals

by Richard Susskind and Daniel Susskind

OCTOBER 11, 2016

https://tnw.to/2p01MpC
Artificial intelligence is neither artificial nor is it intelligent.
It’s math that we learned how to automate (i.e., software)
Stanford algorithm can diagnose pneumonia better than radiologists

Stanford researchers have developed a deep learning algorithm that evaluates chest X-rays, over a month of development, their algorithm outperformed expert radiologists.

BY TAYLOR KUBOTA

European Journal of Cancer
Volume 118, September 2019, Pages 91-96

Elsevier

Deep learning outperformed 11 pathologists in the classification of histopathological melanoma images

Achim Hekler a, Jochen S. Utikal b, c, Alexander H. Enk d, Wiebke Solass e, Max Schmitt a, Joachim Klode f, Dirk Schadendorf f, Wiebke Sondermann f, Cindy Franklin g, Felix Bestvater h, Michael J. Flaig i, Dieter Krahli j, Christof von Kalle a, Stefan Fröhling a, Titus J. Brinker a, d, g, e
the number of papers published each year since 2000 that discuss an ML application to Orthopedics.

ONE DOES NOT SIMPLY DROP OFF A PREDICTIVE MODEL
Case Study:

Reduce unnecessary knee replacement surgeries
The problem

~700,000 TKAs in the US this year. Expected to double by 2030.

15% and 25% of surgeries result in no meaningful improvement.

That’s 130k surgeries ($4B) per yr. of waste.

*Clinical Validation of a Patient Specific Shared Decision Making Tool for Use During the pre-Total Knee Arthroplasty Consultation. Orthopedic Proceedings Volume 100-B. April 2018.*
The idea

What if patients and surgeons knew the likely outcomes *before the surgery*?
Lesson 1:
Use data to make it personal
22.8% of patients do not have minimal pain relief (MCID)

Estimated at over 700 patients per year
Wide Variation in MCID % by Surgeon

<table>
<thead>
<tr>
<th>Surgeon</th>
<th># Procedures with PROMs (3 months of data)*</th>
<th>% that achieved PROMIS MCID</th>
<th>% that achieved KOOS MCID</th>
<th>% that achieved VAS MCID</th>
<th>Median Pre VAS Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgeon A</td>
<td>92</td>
<td>63.0%</td>
<td>82.6%</td>
<td>80.4%</td>
<td>6</td>
</tr>
<tr>
<td>Surgeon B</td>
<td>66</td>
<td>68.2%</td>
<td>81.8%</td>
<td>84.8%</td>
<td>5</td>
</tr>
<tr>
<td>Surgeon C</td>
<td>57</td>
<td>57.9%</td>
<td>82.5%</td>
<td>82.4%</td>
<td>5</td>
</tr>
<tr>
<td>Surgeon D</td>
<td>57</td>
<td>57.9%</td>
<td>80.7%</td>
<td>77.2%</td>
<td>5</td>
</tr>
<tr>
<td>Surgeon E</td>
<td>53</td>
<td>66.0%</td>
<td>84.9%</td>
<td>79.2%</td>
<td>4</td>
</tr>
<tr>
<td>Surgeon F</td>
<td>47</td>
<td>55.3%</td>
<td>74.5%</td>
<td>72.3%</td>
<td>4</td>
</tr>
<tr>
<td>Surgeon G</td>
<td>45</td>
<td>55.6%</td>
<td>80.0%</td>
<td>68.9%</td>
<td>4</td>
</tr>
<tr>
<td>Surgeon H</td>
<td>37</td>
<td>56.8%</td>
<td>94.6%</td>
<td>89.2%</td>
<td>6</td>
</tr>
<tr>
<td>Surgeon I</td>
<td>34</td>
<td>44.1%⁺</td>
<td>55.9%⁺</td>
<td>55.9%⁺</td>
<td>4</td>
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</table>

*Top 9 surgeons represent 488 of 571 procedures
Small Variation in Case Mix

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<tr>
<th>Surgeon</th>
<th># Procedures with PROMs</th>
<th>Median Age</th>
<th>Median BMI</th>
<th>Median Pre VAS Score</th>
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</thead>
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<td>92</td>
<td>64</td>
<td>30</td>
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</tr>
<tr>
<td>Surgeon B</td>
<td>66</td>
<td>66</td>
<td>32</td>
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<tr>
<td>Surgeon C</td>
<td>57</td>
<td>66</td>
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<tr>
<td>Surgeon D</td>
<td>57</td>
<td>68</td>
<td>31</td>
<td>5</td>
</tr>
<tr>
<td>Surgeon E</td>
<td>53</td>
<td>68</td>
<td>29</td>
<td>4</td>
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<tr>
<td>Surgeon F</td>
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<td>34</td>
<td>65</td>
<td>32</td>
<td>4</td>
</tr>
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</table>
Lesson 2:
People don’t want to be replaced by robots.
Lesson 3:

Invite the clinical team “under the hood” from the start.
SPONSORED POST

Healthcare must overcome AI’s ‘Black Box’ problem

For artificial intelligence to gain wider interest from clinicians, the way the algorithms arrive at their conclusions needs to be understandable.

By STEPHANIE BAUM

Post a comment / Jan 9, 2019 at 1:02 PM
Important Feature Set Used by the Model

- KOOS Jr Instrument
- VAS Instrument
- BMI
- Age
- Family History of Arthritis
- Family History of Cancer
- Avg Drinks per Week
- Urinary Retention
- Dx Osteoarthritis
- Family History of Dementia
- Family History of Diabetes
- Long Term Pain Management Meds
- Requires Use of Assistive Device or Brace
- Normal heart rate and rhythm
- Travel Outside of US < 1 Year
- **Dx Complications of Implant**
- Planning to go home post surgery
How you present results matters

Actually Improved vs. Model Confidence

Model Confidence in Improving (Improvement Bar)

% Patients who Improved

100% 95% 90% 85% 80% 75% 70% 65% 60% 55% 50%

Every patient, 2 year period
How you present results matters

Actually Stable/Worse vs. Model Confidence

Model Confidence

Actually Stable/Worse
Lesson 4:

Machine learning results are suggestions. Healthcare adopts solutions.
Personalized predictions
Lesson 5:

Innovation’s greatest competition is the status quo.
CODMAN
ERNST AMORY

MD 1860-1920

GATHERER OF
OUTCOMES DATA AND
QUALITY MEASUREMENTS
IN HEALTH CARE

IT MAY BE A HUNDRED
YEARS FROM NOW...
“It may take a hundred years for my ideas to be accepted.”
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