Revised Analysis

Module 3

Occupation: General Physician

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Abstract

Taylor's task-model approach was used in the beginning of our understanding to appropriately evaluate the breakdown of the work of a given occupation. Using this task-based approach, the initial analysis highly followed the model from the Mckinsey Report. Mapping a set of Activities to a set of Capabilities that represent the requirements of an occupation. These capabilities have a criterion for automation with a score. A high score meaning human levels of capability implying difficulty for automation. The initial analysis of a Medical Doctor or Physician had 5 categories for a total of 15 activities for clarity.

1. Medicine
    a. Diagnose Disease/Injury
    b. Prescribe Medicine, Treatment, or refer to specialist
    c. Administer Tests and Analyze results
2. Documentation
    a. Collect, Record, Maintain patient information
    b. Work with scheduling, email, and medical software
    c. Plan, Prepare, and administer Health programs
3. Knowledge
    a. Current Medical Knowledge and Practices
    b. Math, Biology, and Pathology Knowledge
    c. Pharmacology and Drug Interactions
4. Communication
    a. Coordinate/Train other health professionals
    b. Understanding/Expressing emotional cues
    c. Oral/Written comprehension with patients/professionals
5. Physical Tasks
    a. Perform Physical Test
    b. Operating on Patients
    c. Deliver Babies

Each of these Activities have a mapping of capabilities that suggest that the susceptibility to automation is low. This revision for the model discusses the shortcomings and issues for capturing the reality of the work of a Physician which lead to a weak prediction of automation susceptibility. For this updated model two Physicians were interviewed to gain insight into how the model could be improved along with supporting literature to capture the current landscape of automation within the industry.

Methods

To understand the occupation requirements on a deeper level, two Physicians were interviewed; a Radiologist and General Practitioner. The interviews were broken up into three parts. (1) General unbiased discussion of what tasks are necessary for day to day completion of their occupations. (2) The model was explained to them and a discussion of how accurate their profession was represented. What was correct/incorrect. (3) Current tasks within their occupation that they deem susceptible to automation.

A journal, 'Artificial intelligence in healthcare: past, present, and future' by Jiang F *et al* and a research article ' Will Doctors Fear Being Replaced by AI in the Hospital Setting' by Bharadwaj add to the discussion. To give insight into what areas of the occupation are susceptible based on what is currently being automated and why.

Findings and Analysis

To what extent does my initial model reflect the reality of this occupation?

The interviews with the two Physicians revealed some major issues with the first model.

(1) The first is that the entire model is based on what responsibilities a Doctor has by assumptions and no primary source. The model was created with general knowledge of what doctors do through the use of O*NET and being a patient. The break down that this website has is a general list of vague requirements that can fill a large amount of occupations and what's necessary to get through school but realistically some of these tasks are done by ancillary support staff and not done by all Physicians.
(2) There was discussion that the mapping of capabilities themselves are a good measure of how much is required within each specific Activity yet there is some uncertainty of the scoring method. 0 being likely to be automated and 3 being human like levels needed. Each score has task specific context that makes it difficult to place where the score lands since it's a discrete measurement and not continuous.
(3) The activities themselves in the current model need to be reworked to represent a more specific picture of the work as a Physician. For example, an activity could be Diagnose Disease which is a reasonable activity they must perform. Yet the complexity of a diagnoses involves many layers such as communication, tests, and ancillary occupations. The layering of the activities causes an ambiguity of the mixture of tasks. Some activities might rely on others, some may be singular enough to be mapped to capabilities but the current model does not reflect this ordering of work needed. This suggests a potential time-based approach which will be discussed further.
(4) The largest hole in the model is when discussing an average day of work for a Physician. The timeline of things that needed to be done was quite routine. Some of the activities were presented yet some were only partially used. Zooming in on an activity presented a difficulty in expressing that occupation based on the capabilities. An example of this is the communication from Physician to Patient to accurately diagnose a disease is considerably complex due to the correct information being needed. Many diseases/illness/injuries etc. can be caused by several different sources. Proper patient history is needed to address all possibilities. A patient could be looking for a cause of lower back pain but not mention that they bought a new bed and didn't think it was important to mention. This lack of information can be difficult for a machine learning algorithm to come to a diagnosis when the answer could be 100 different results which lacks the information withheld from the data. This leads to more specific models such as binary classifiers such as Decision Trees or Logistic Regression (Jiang *et al*, 2017, p. 235) that ask more specific questions such as does the patient have Breast Cancer, Yes or No. In short, the model does not capture the level of human to human interaction needed just to gain the necessary information to perform an accurate diagnosis.

Issues with current model

Outside of the discussion of whether the model is a good reflection of the specific occupation there are other general problems the model has from a structural perspective.

(1) The model developed by the McKinsey Institute was used to assess ~800 occupations and ~2000 activities across all occupations:

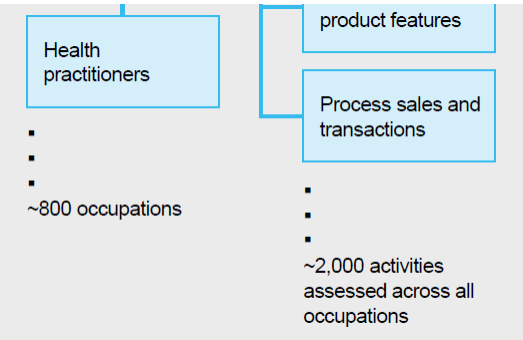

Figure 1

This approach is very generic across all occupations and does not do a good job at reflecting the specificity of each occupation. Why would the same 2000 activities be applied against a Teacher and a Bus Driver? Since this was just the framework the first model was able to narrow the model to focus on Physicians but the setup was borrowed from this generic model. A revision is clearly needed.

(2) The interviews revealed that while narrowing a single occupation into its constituent parts seems like a simple approach to evaluate what's necessary to automate it. Many of the tasks of a physician are supported by ancillary occupations such as Nurses, Pharmacists, Physician Assistants, Receptionists etc. . The generic approach above could help support this unless it's analyzes more difficult tasks to automate. Communication between staff seemed to be a huge bottleneck in the case of Physician.

(3) As discussed in the previous section, Activities and what they represent could be quite vague or need to be broken down further. Once an activity is broken down further there is some cross ambiguity of what they represent. Consider this Activity breakdown:

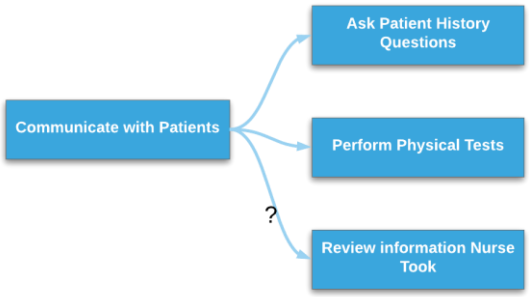

Figure 2

Communicate with Patients could be further broken down into many different sub-activities each needing a different mapping of capabilities. If this activity wasn't explored enough then an

inaccurate representation of what capabilities are needed could be the result. Also, there is a question of whether some Activity that is broken down is already represented by a different type of Activity.
(4) The model doesn't capture the minutia of everyday work. Perhaps a portion of the occupation could be automated. Then some sort of work is going to be required to integrate that into the system arguably adding a different task.
(5) The task-based model doesn't represent the feasibility of automation in theory an entire occupation could be susceptible right now according to this model but might not be cost effective, reasonable, or helpful. The interview with the Radiologist said a lot of the tests could be automated with current technology but would be a logistical nightmare with healthcare/insurance costs. Unnecessary tests are already a burden which increase healthcare costs.

Revision of the model, possible limitations

A revision to the model is needed. Since more liberty is taken, this model will narrow specifically to the occupation of a Physician. Discussion with the Physicians lead to a new realization borrowing the Activities/Capabilities from the previous model but extending chronological ordering to the events to capture the reality of the occupation. Breaking down the occupations into Activities based on time not generic tasks. The requirements of the occupation will be presented if enough days are evaluated. The model below captures a segment of the day of a working physician in a clinical setting discussing patient history, diagnosis, and treatment:

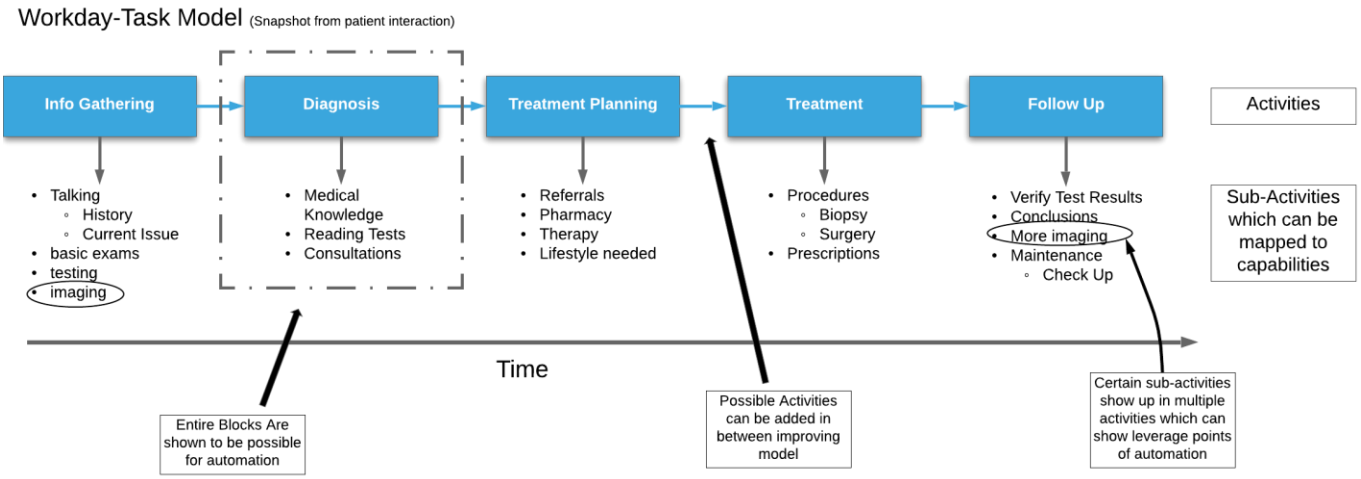

Figure 3

This model is a simplified version of a larger example of the entire day of the Physician. With enough data collection and enough days captured the model could include the complexity needed to have a better idea of the level of automation. This specific portion of the day in the life of a physician is meeting the patient. This particular section could loop over and over as shown in Figure 4. Routine work and loops of this work can be captured and leveraged to discover a better reflection of the occupation.

Moving from Patient to Patient

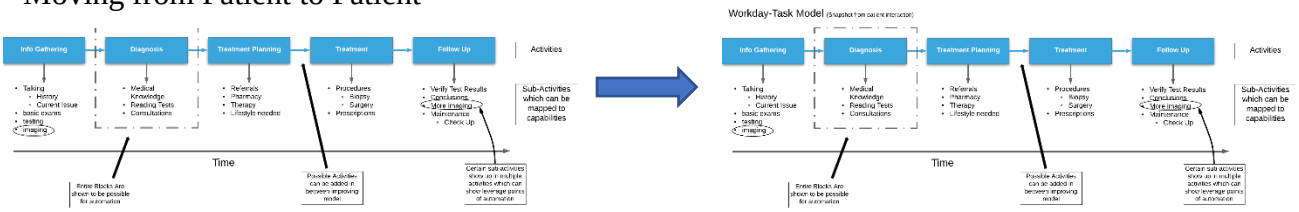

Figure 4

Since this is a chronological ordering of real work for the Physician, less ancillary work is caught in the middle.

Limitations

(1) While Ancillary occupations cause less ambiguity, they still exist within the model.
(2) While capturing loops or routine actions may seem automatable, each repeated task may be unique enough to be difficult to capture as automatable.
(3) The model is very specific to a single occupation.
(4) A large amount of chronological activities and sub-activities are needed to be a useful model.

Reflection on the Revision and Susceptibility to Automation

The occupation is still unlikely to be automated and both models capture this. In the Workday-Task Model entire sections can be eliminated such as the diagnosis within patient interaction. According to Jiang et Al and Bharadwaj this an area of current susceptibility using machine learning. However, with this snipped out of the model; a large portion of the occupation still remains. Imaging is also susceptible but with Physicians working within the AI era they must work alongside computers (Bharadwaj), 'Bad data may contribute to a cascade of inaccurate clinical data, putting patients at risk.'. Radiologist's entire list of tasks are at risk of getting automated which was also a fear gathered in the interview. Yet in the article it's mentioned they will still be needed to inform the interpretation of data. The general Physician, however, only uses this as ancillary work through consultation/referral. The level of communication earlier reflected how difficult it is to gain an accurate diagnosis due to how difficult it is to interpret patient history. Yet the current climate of AI in the field says this is the area most susceptible. This shows how complicated the different views of how this field will be automated are perceived. What is certainty is the mixture of AI models and Physicians working together on the horizon. Other large portions of the industry such as surgery, treatment, and therapy aren't shown to be nearly as susceptible.

References

Bharadwaj, Raghav. (2019, February 2019). *Will Doctors Fear Being Replaced by AI in the Hospital Setting.* Retrieved from https://emerj.com/ai-sector-overviews/will-doctors-fear-being-replaced-by-ai-in-the-hospital-settling/

Jiang F, Jiang Y, Zhi H, et al Artificial intelligence in healthcare: past, present and future, Stroke and Vascular Neurology 2017;2:doi: 10.1136/svn-2017-000101

Interviews with a Radiologist and General Practitioner