



COMP501

Assignment 3

Artificial Intelligence within Surgery | Team 1213
Peter Scandle | Semester 1 2022



Overview of AI

Overview of Artificial Intelligence

- Three main types used within surgery:
 - Machine Learning (ML)
 - Self-learning
 - Neural Network (NN)
 - Deep learning – subsidiary of ML
 - Uses nodes, is created to function similarly to the human brain
 - Works better with complex datasets
 - Computer Vision (CV)
 - Extract high-level data from images
- Combination of all three is required in surgical analysis

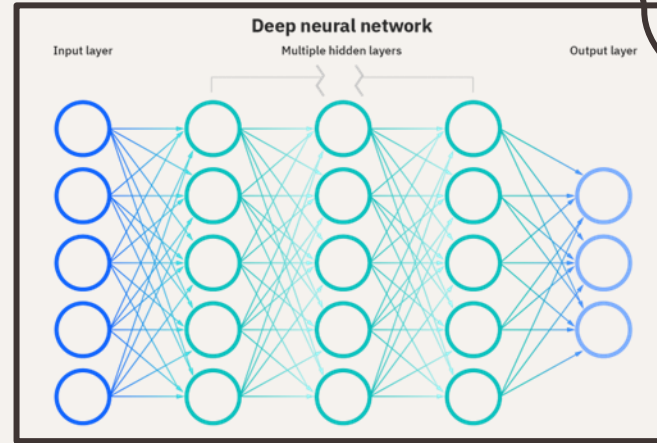


Figure 1: Deep Neural Network (Education, 2020)

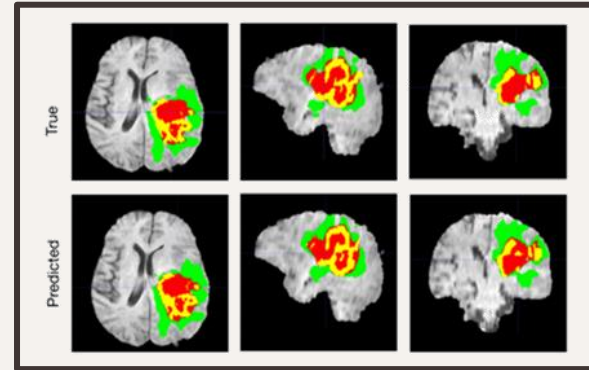


Figure 2: Computer Vision in Healthcare (altexsoft, 2021)

What can AI offer Surgery?

Current Opportunities:

- Increased accuracy in diagnosis
- Detection of complications during surgery (real-time risk analysis)

Future Possibilities

- Reduction in complications during surgery (robotic assistance)

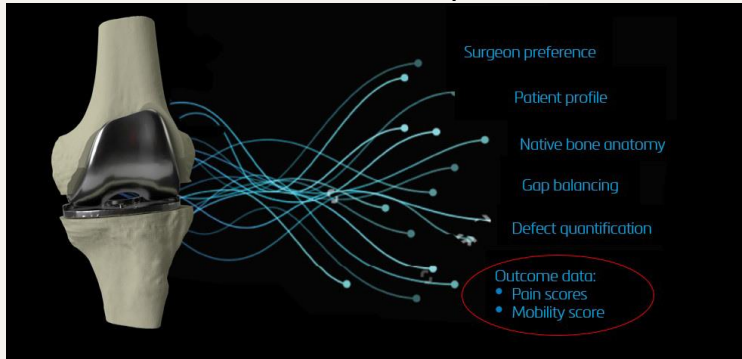


Figure 3: How AI Will Change the Way We Do Pre-Surgical Planning (Lambrechts)



Figure 4: Cientistas dos EUA criam braço robótico capaz de sentir objetos (Filizola, 2019)

Choices Available

Current Choices:

- Pre-operative assistance
 - Autonomous recognition of pre-existing issues
 - Autonomous tumour detection
- Assistance during surgery
 - Real-time risk analysis of complications / unforeseen issues

Future Options:

- Robot Assisted Surgery
 - Autonomous keyhole surgery
 - 'Pool' surgical experience between robot and surgeon to minimise complications

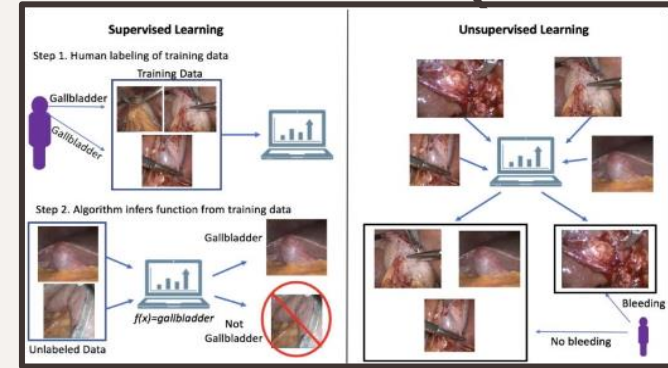


Figure 5: Artificial Intelligence in Surgery (Hashimoto, Rosman, Rus, & Meireles, 2018)



Figure 7: Robots give surgeons a helping hand (Barnes, 2022)

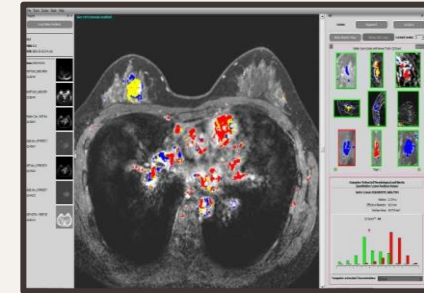


Figure 6: FDA-Cleared Artificial Intelligence Breast Cancer Diagnosis System Launched by Paragon Biosciences

Risks

Risks

- Liability – Who is at fault when an error occurs?
 - Interesting to observe survey results – 20% of people think that either the AI itself the developer should be at fault
- Bias - insufficient training data / imperfect algorithm
 - Errors can occur if the algorithm isn't perfect for the situation or the situation is markedly different from data the model was trained with
- Privacy – sensitive medical data

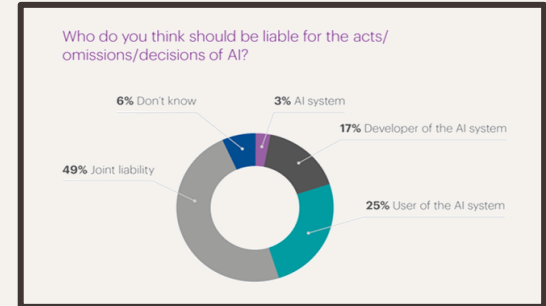


Figure 8: Key Challenges of Artificial Intelligence (Briz, 2021)

Team Cohesion & Output

Peter Scandle

- Team Leader
- Principal Developer
- Scrum Master

Deployed Website:

<https://pscandle.github.io>



References

- altexsoft. (2021). Computer Vision in Healthcare: Creating an AI Diagnostic Tool for Medical Image Analysis.
- Barnes, O. (2022). Robots give surgeons a helping hand. *Financial Times*.
- Briz, N. B., Allison. (2021). Key challenges of artificial intelligence: Liability for AI decisions.
- Education, I. C. (2020). Neural Networks.
- Filizola, P. (2019). Cientistas dos EUA criam braço robótico capaz de sentir objetos.
- Hashimoto, D. A., Rosman, G., Rus, D., & Meireles, O. R. (2018). Artificial Intelligence in Surgery: Promises and Perils. *Annals of surgery*, 268(1), 70-76.
<https://doi.org/10.1097/sla.0000000000002693>
- Lambrechts, A. How AI Will Change the Way We Do Pre-Surgical Planning: A Study of Total Knee Arthroplasty.
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