Artificial Intelligence in Cancer Surgery

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Nothing to disclose

What is artefitial inteligence?

- In simple words, artificial intelligence is a tool that enables machines to learn from their experience, adapt to new changes and perform tasks just like humans.

Source:

Software

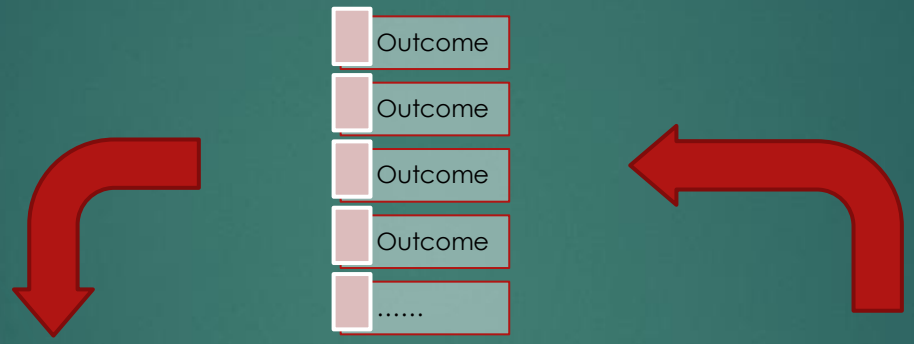
```
public async Task<bool> CreateUser(UserInput input) {
  var validUserTypes = new[] { "regular", "premium", "trial" };

    User user;
    switch (input.UserType) {
        case "regular":
            user = new User(input.Username);
            break;
        case "premium":
        user = new User(input.Username, new List<Permission> {
          "PremiumFeature.Read",
          "PremiumFeature.Create",
        }) {
          IsPremium = true,
        };
        break;
      case "trial":
        user = new User(input.Username) {
          IsOnTrial = true,
        };
        break;
      default:
        throw new ArgumentOutOfRangeException(
          $"Invalid user type. Must be one of the following {string.Join(" ", validUserTypes)}",
          nameof(input.UserType)
        );
    }

  bool result = await repository.CreateAsync(user);

  return result;
}
```

AI vs. conventional software




```
Procedure START
      IF „Glucose level“ > 10 THEN Add Insulin
      IF „Glucose level“ < 3  THEN Add Glucose
END Procedure START
```

OUTCOME

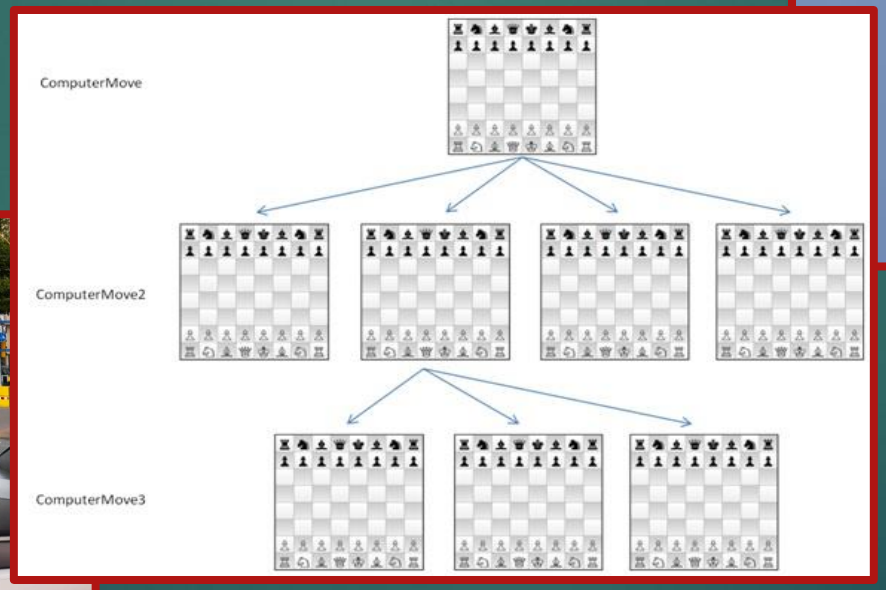
Machine learning is the ability of a machine to learn and modify itself from the results of its actions

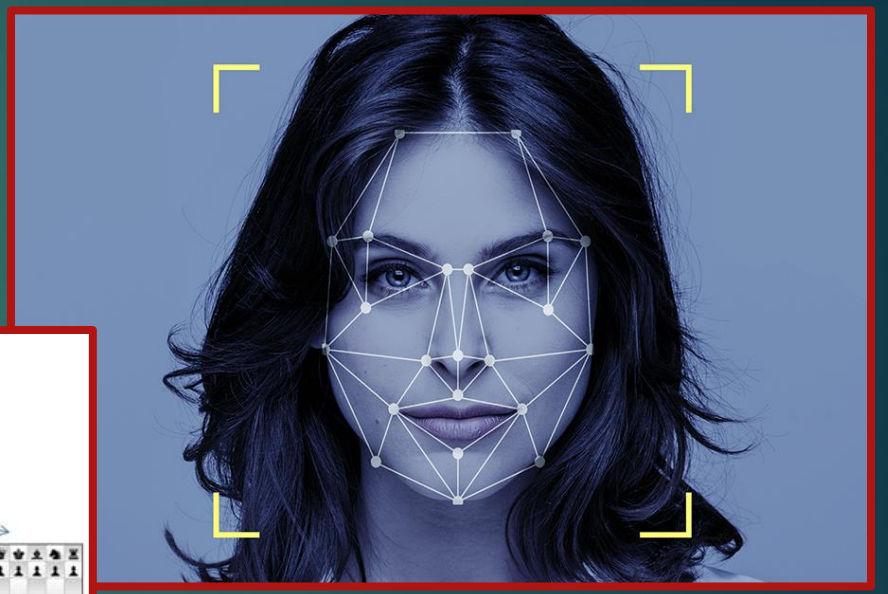
Machine learning

- Computer must be filled not only with input values, but also with the consequences (results).
- Based on these consequences, the software will modify criteria entered by the programmer

Weak AI

- Everything what we have now is part of weak AI, including autonomus cars, ches, face recognition…





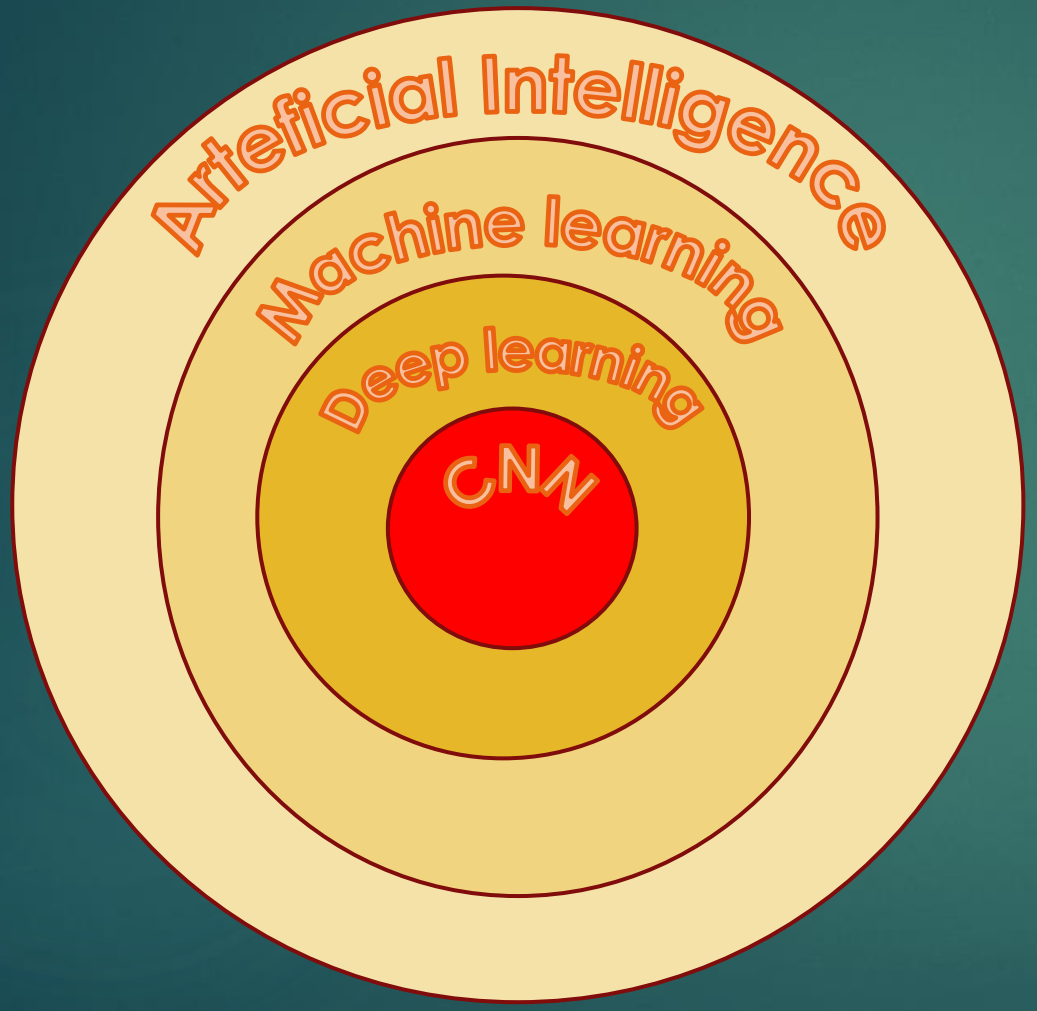
Strong AI


These survival results look quite promising…
Well, we are still missing some data…

Superstrong AI (Artificial Super Intelligence)

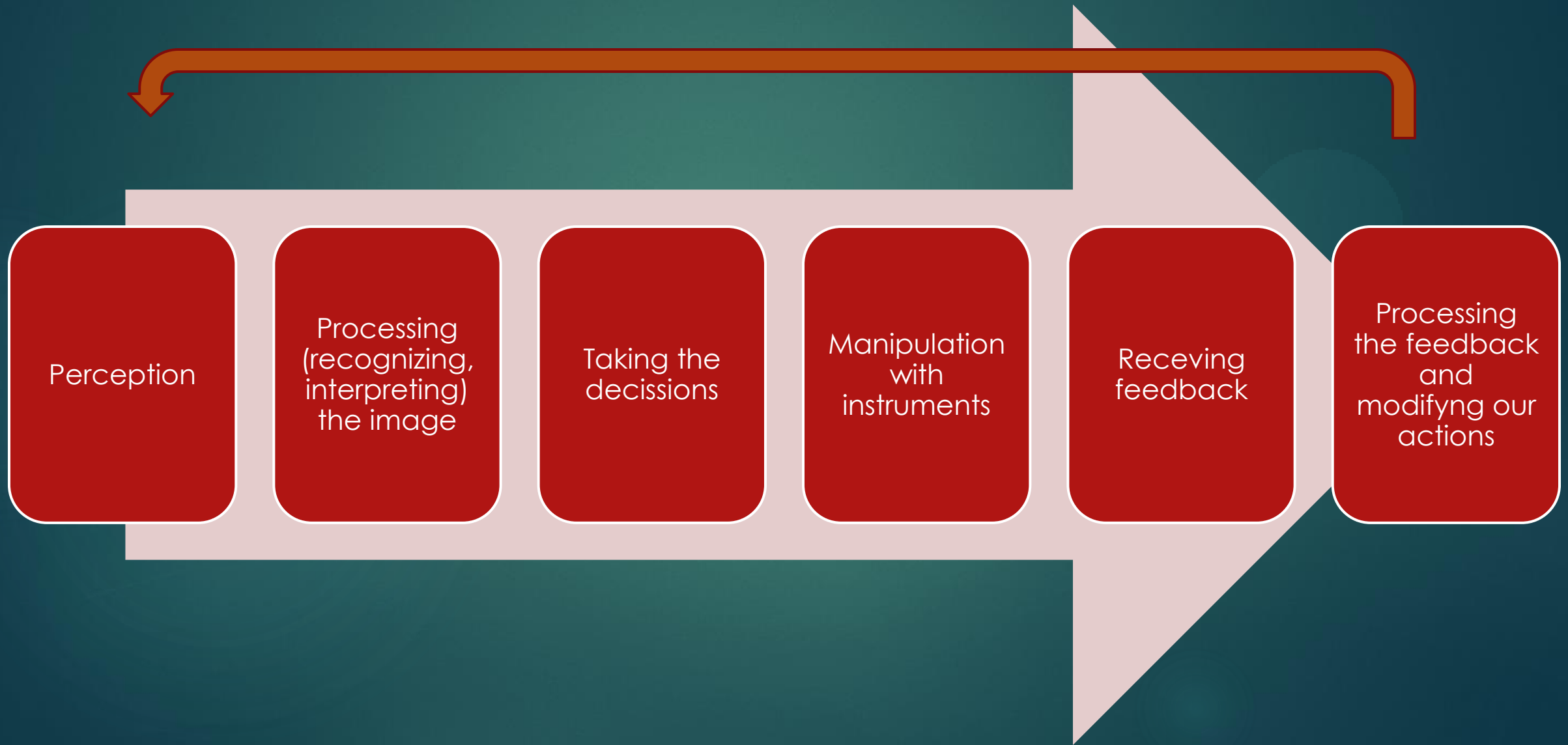
I'll be back!

Layers of AI

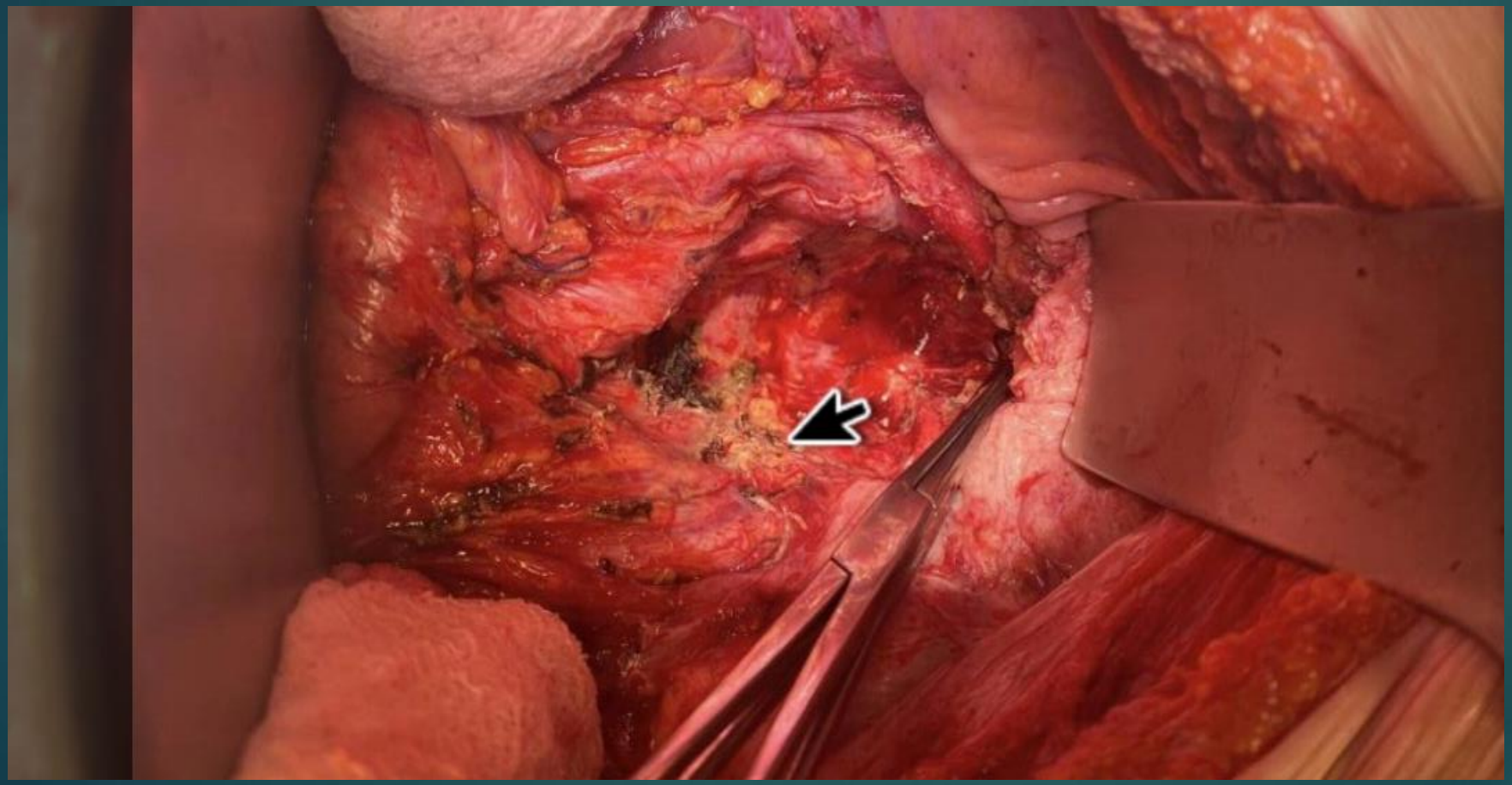


Perception
Planning
Speech Recognition
Problem-solving
Knowledge

Surgical work



Recognizing the parts of the images



Recognizing the parts of the images

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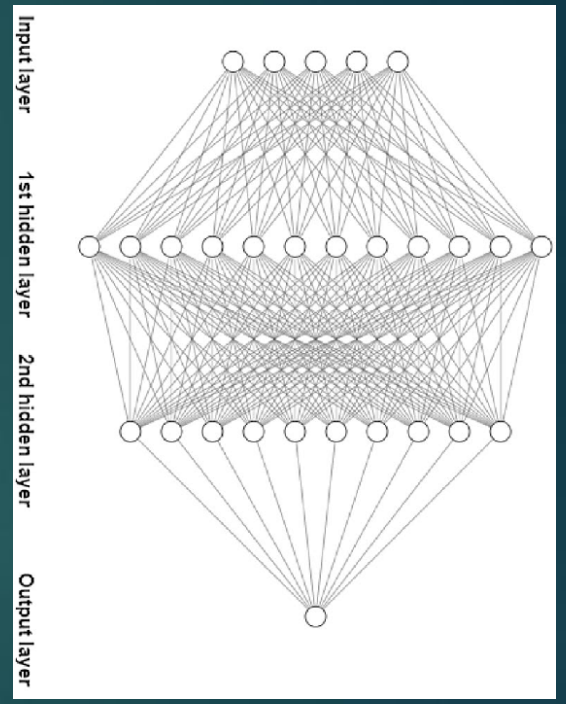
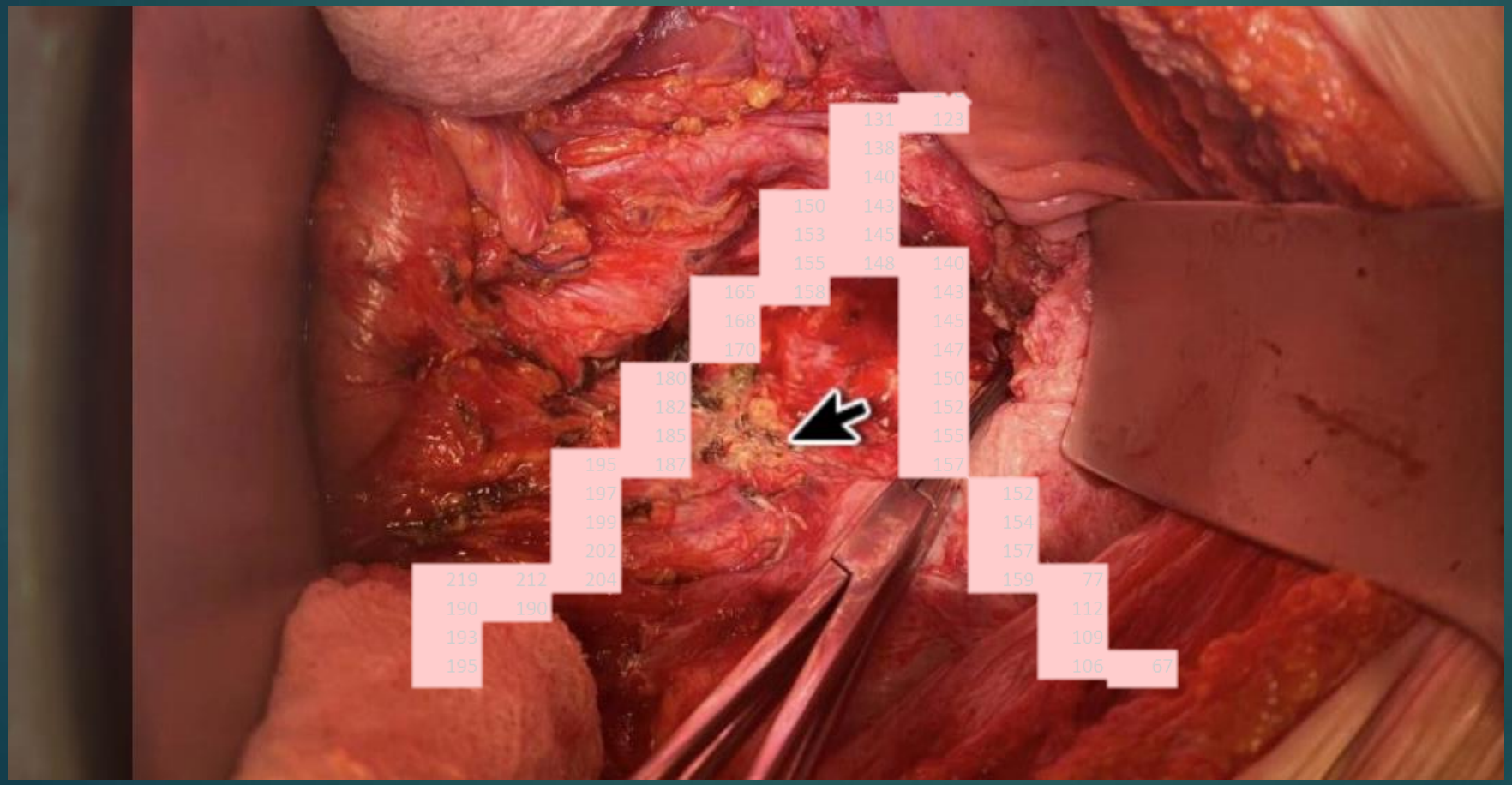
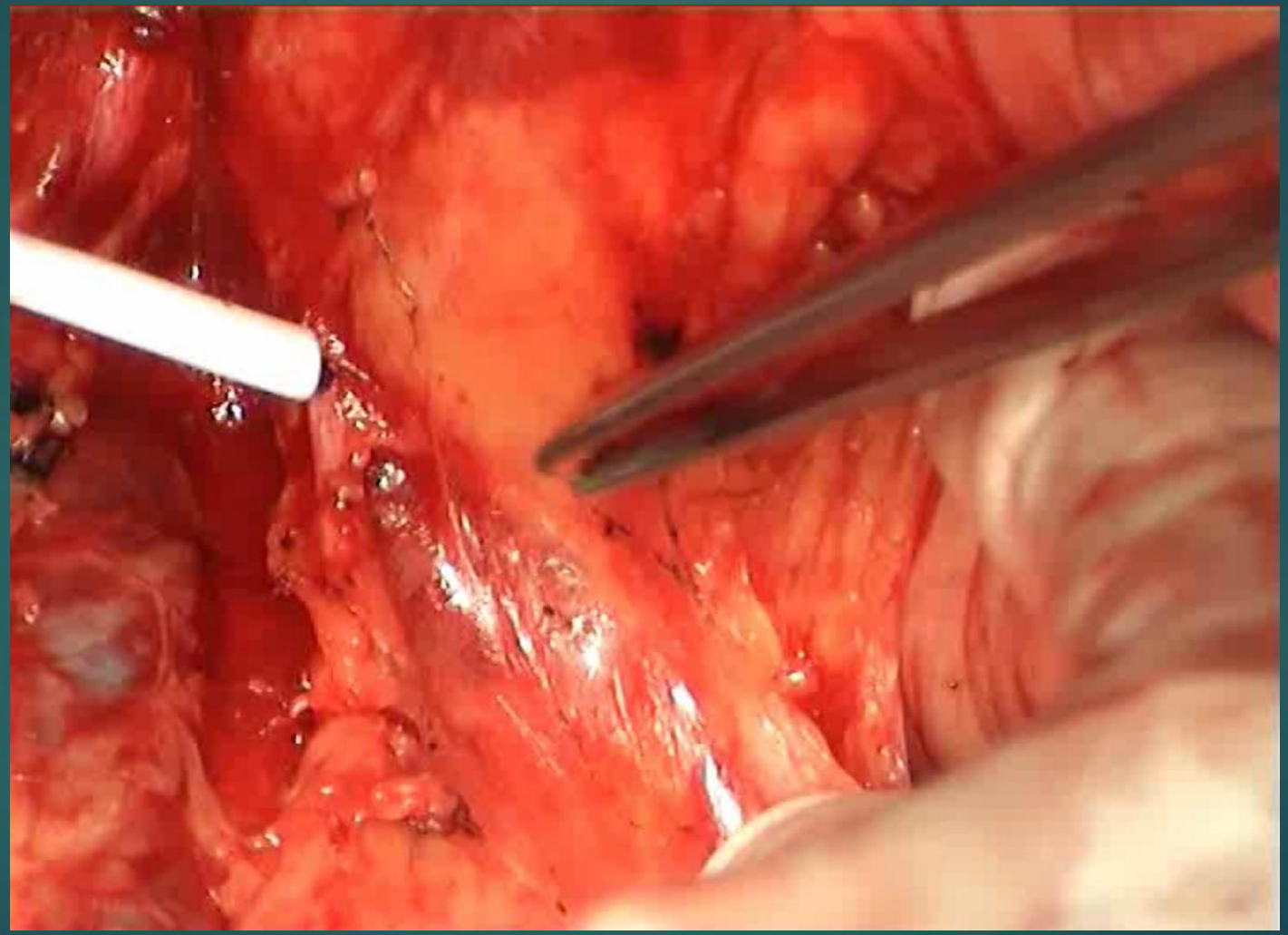


Image created by Samuel Ayanleye

Recognizing the parts of the images



Rectal cancer surgery



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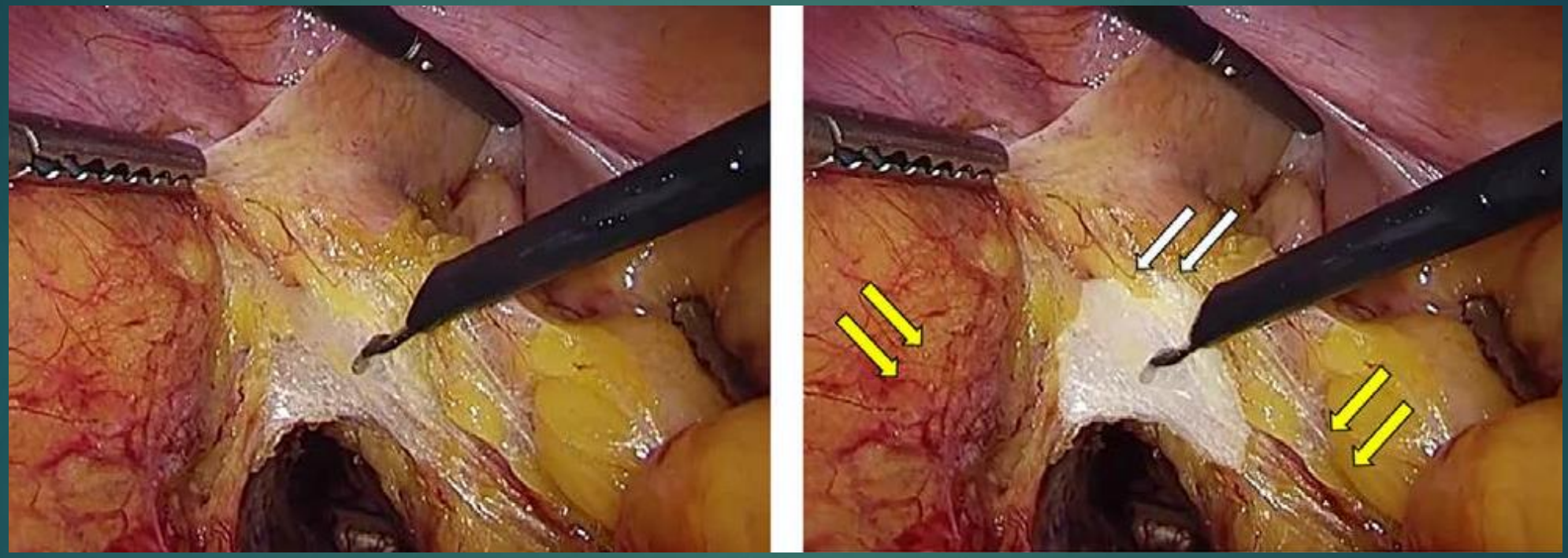
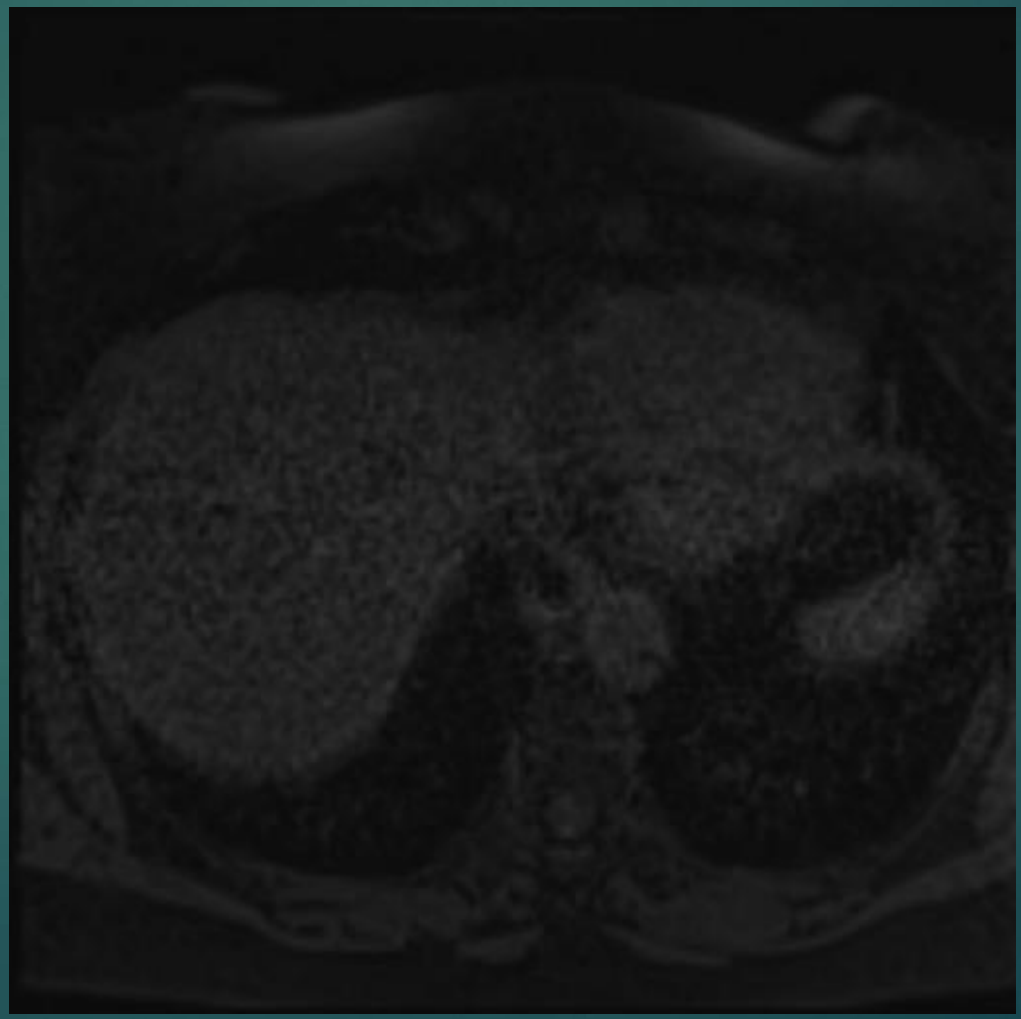
AI guided TME



Igaki T et al. Artificial Intelligence-Based Total Mesorectal Excision Plane Navigation in Laparoscopic Colorectal Surgery. Dis Colon Rectum 2022;
Video available on: https://youtu.be/qVWVVrB7_1s

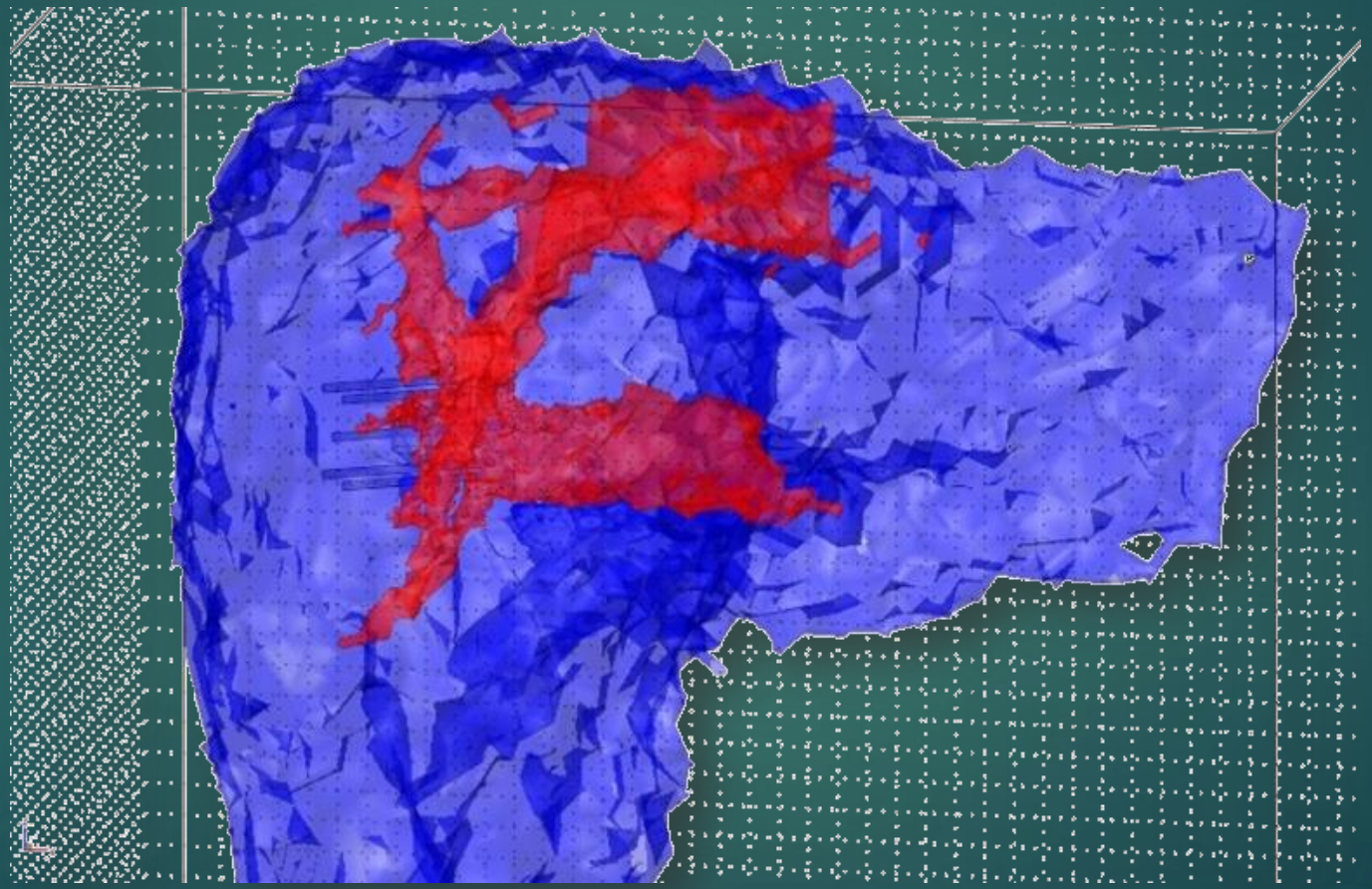
Using AI for the segmentation of CT scans and creating treatment plans for the electrochemotherapy of the colorectal liver metastasis

Treatment planing – Images importing and analysing - 3-D model

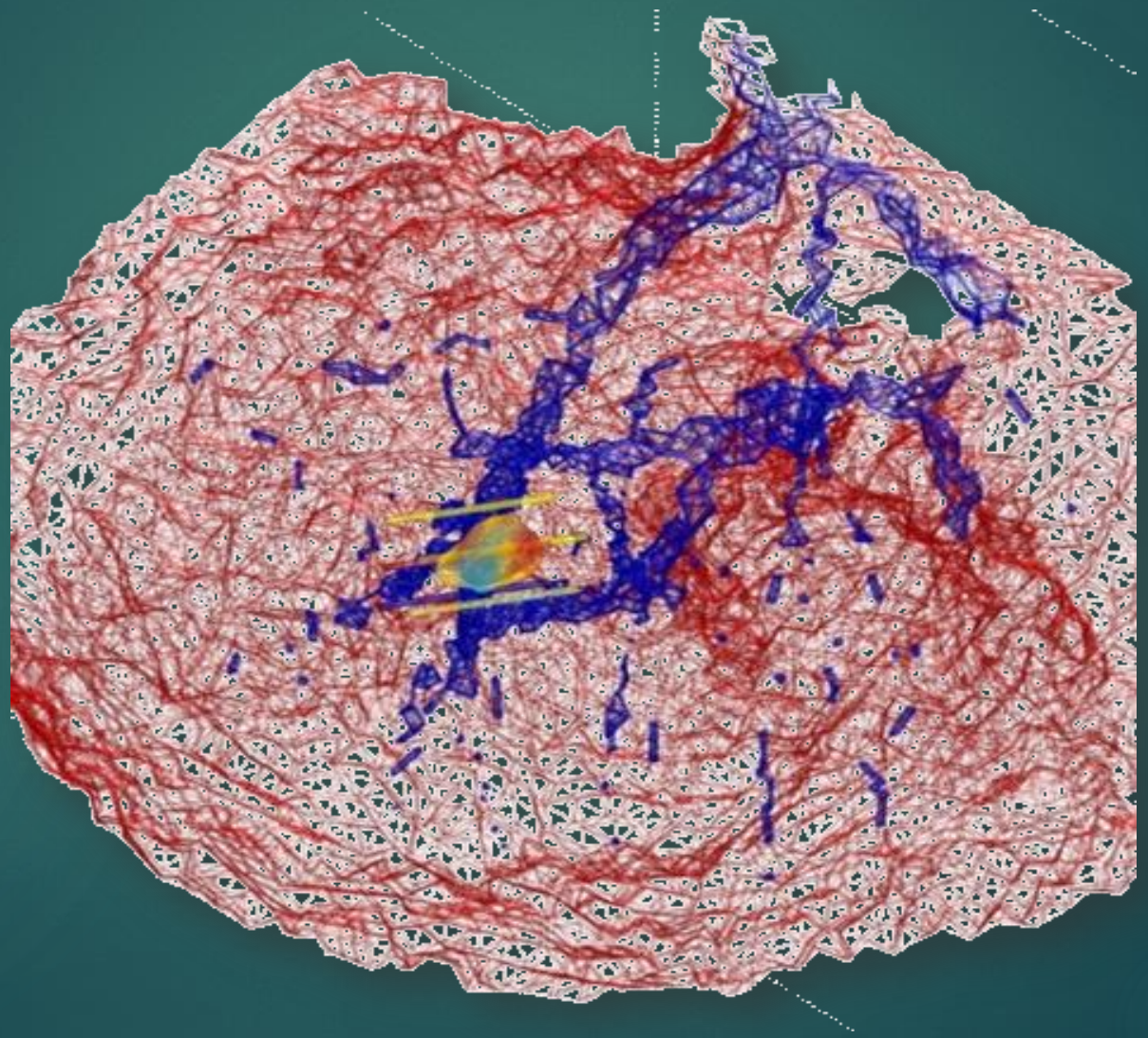


Segmentation

Segmentation

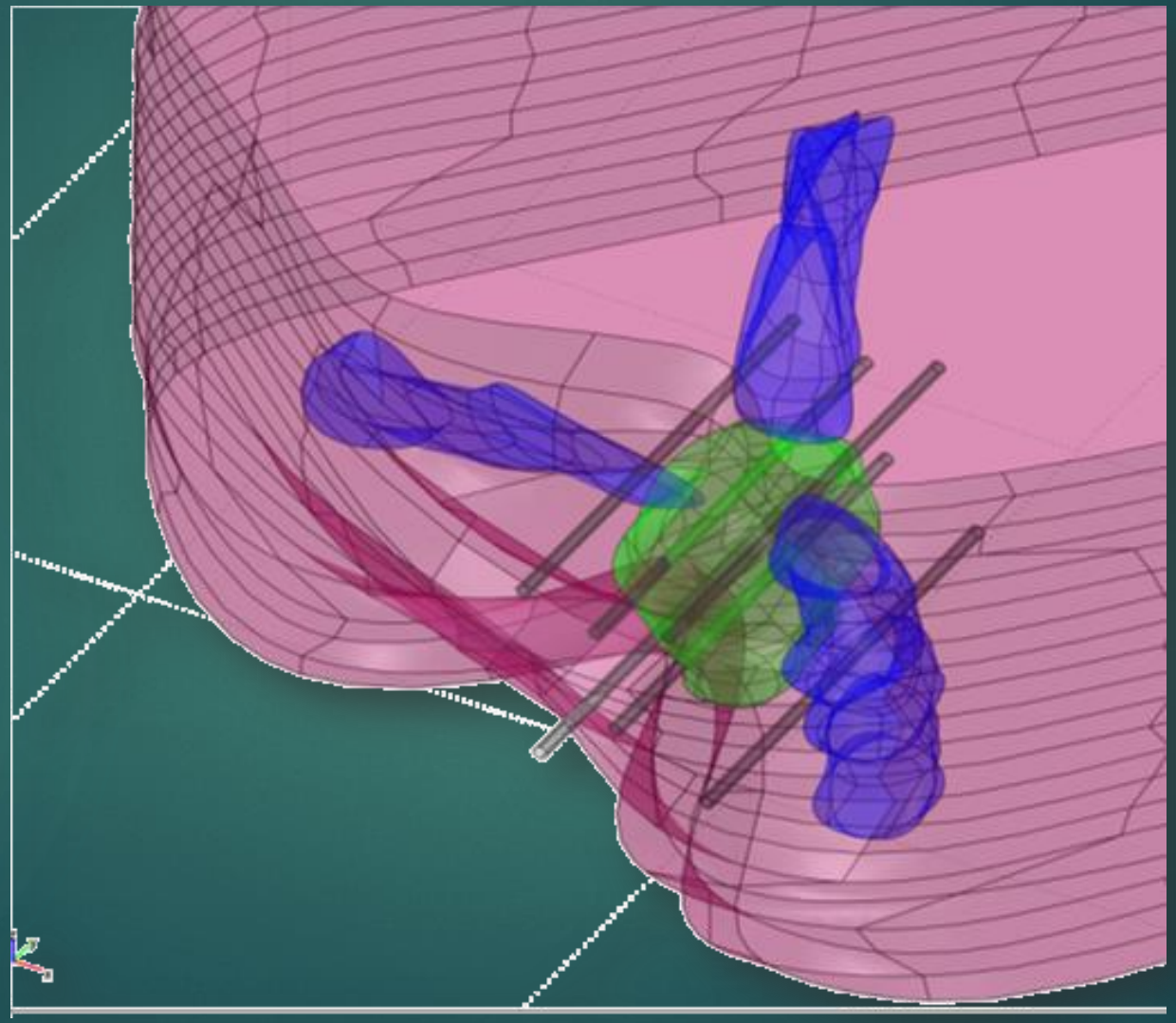


Segmentation



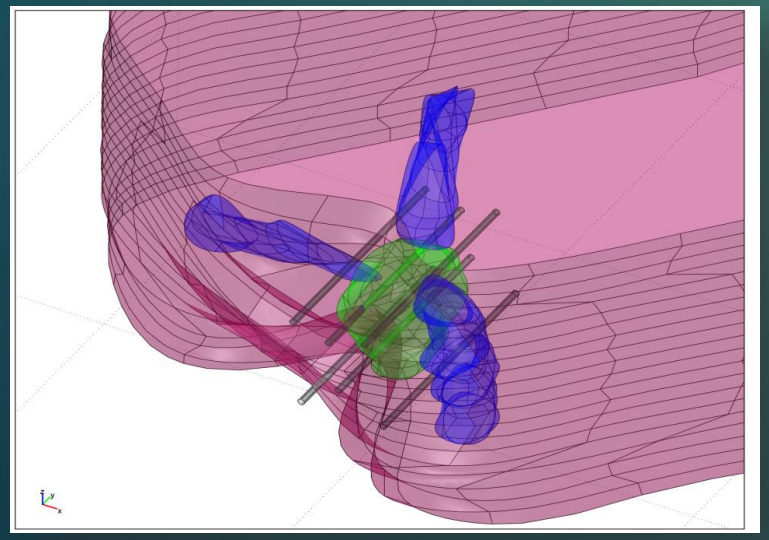
Segmentation

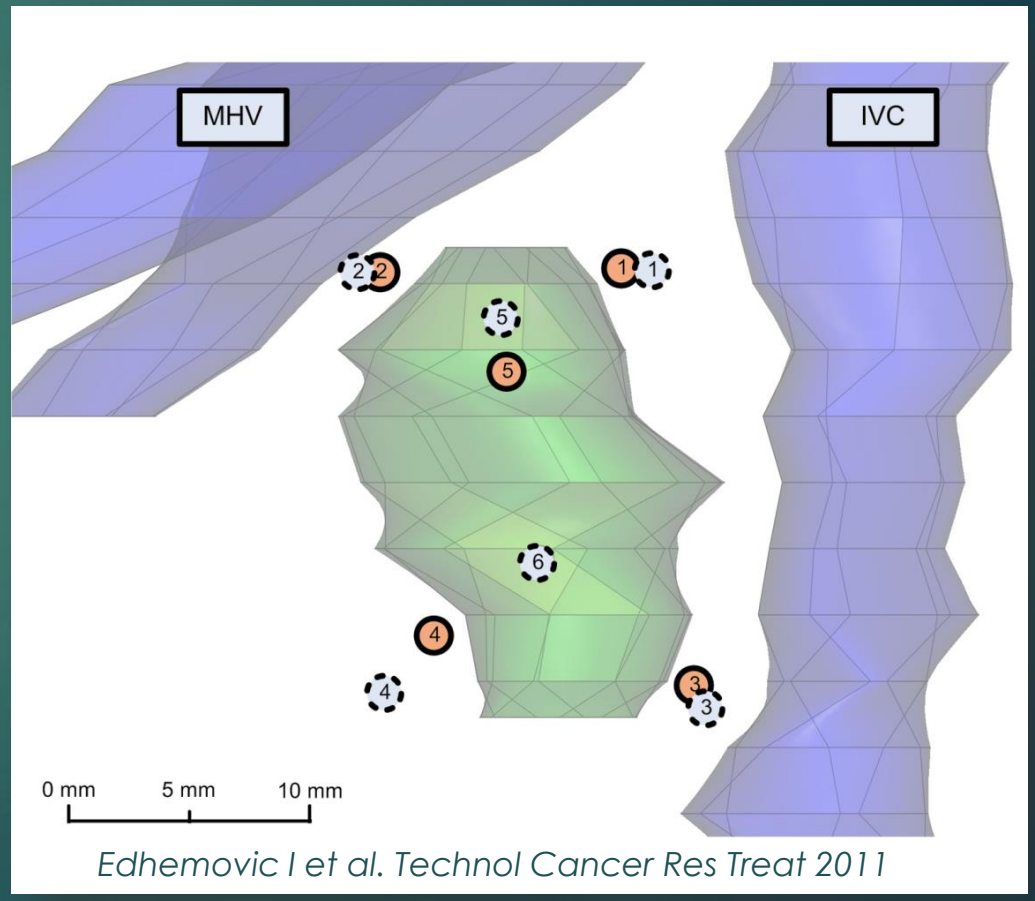
- 3-D model geometry was built based on segmented MRI images of the patient
- Positioning of the electrodes for optimal coverage of the tumor with electric field



Numerical treatment planning

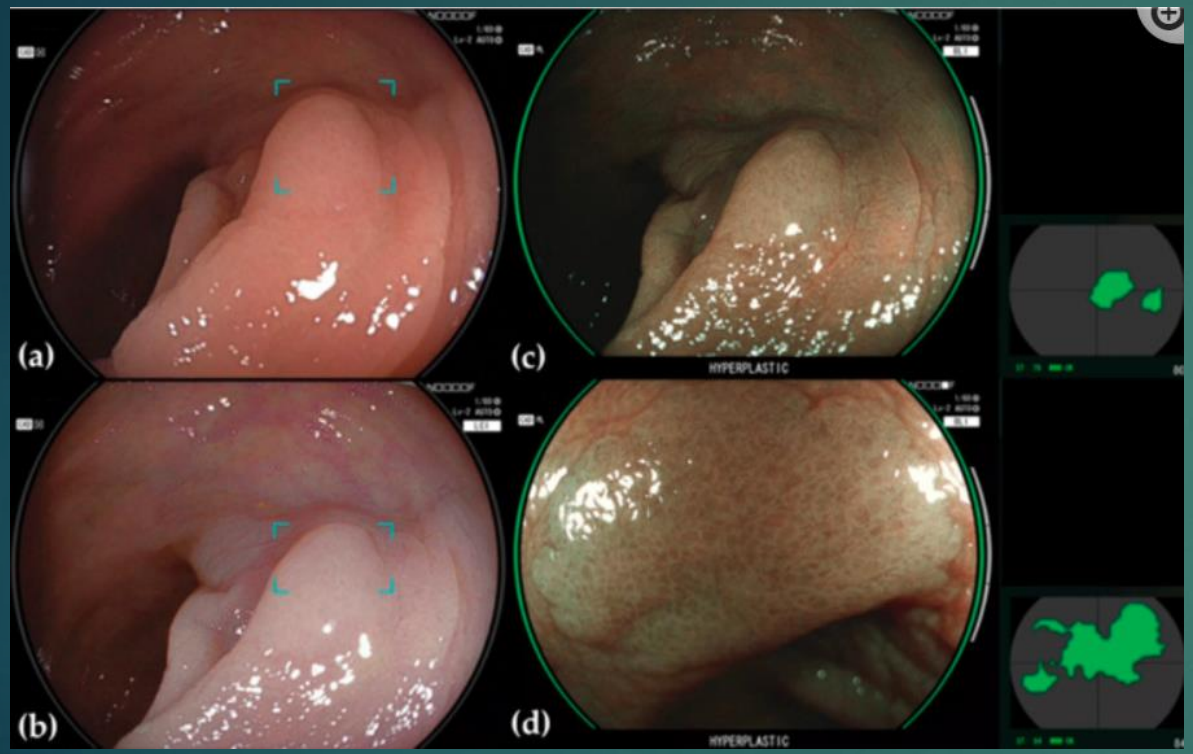
- 3-D model geometry was built based on segmented MRI images of the patient
- Positioning of the electrodes for optimal coverage of the tumor with electric field.

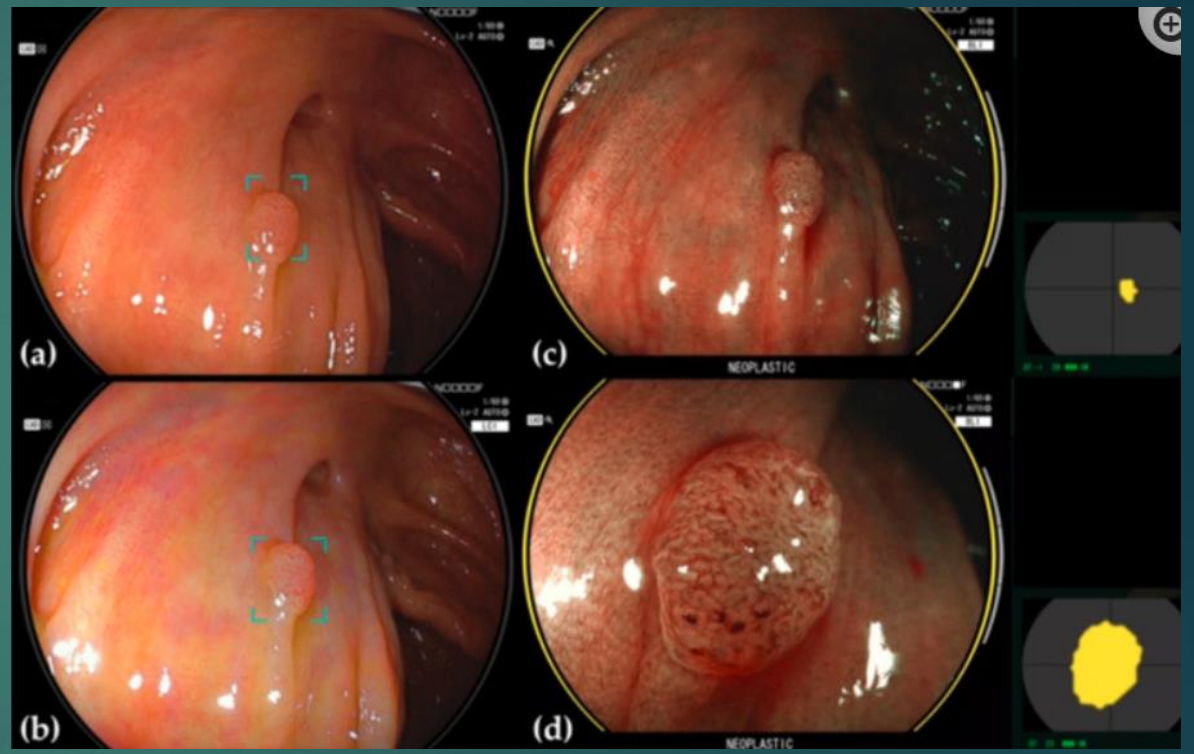




Edhemovic I et al. Technol Cancer Res Treat 2011

Artificial Intelligence in Colonoscopy

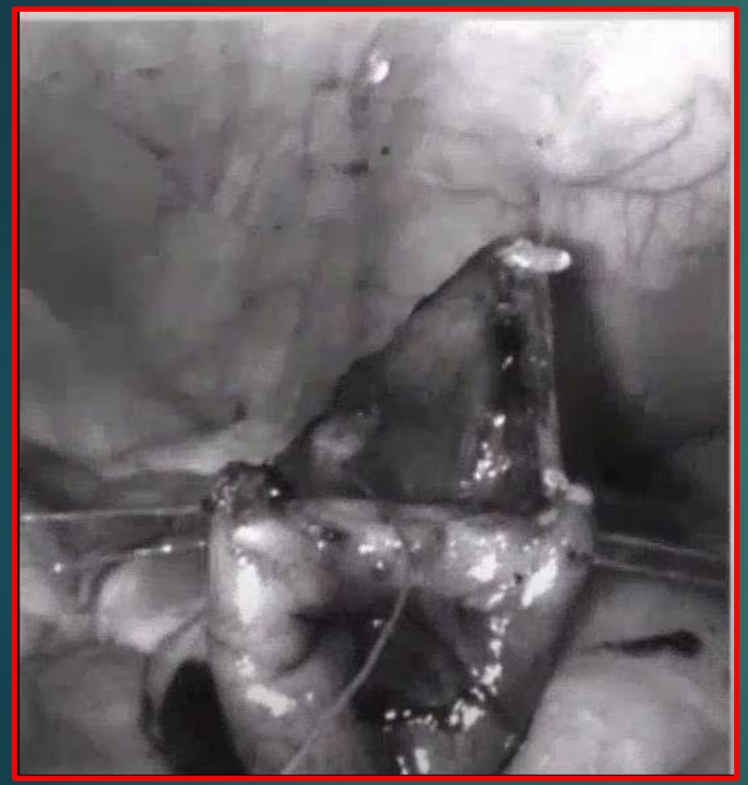


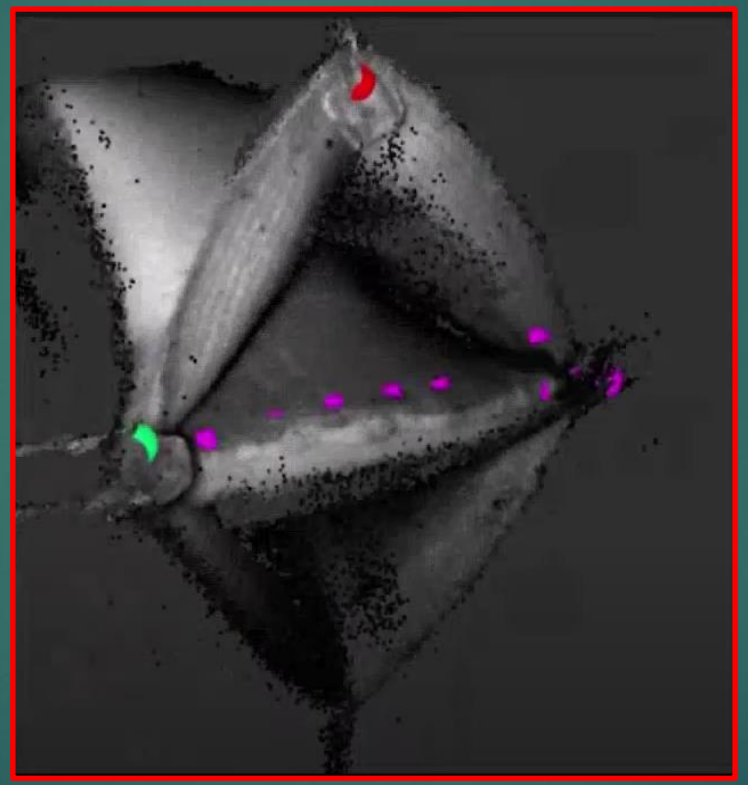


93.0% sensitivity
93.0% specificity

Kamitani Y et al. Current Status and Future Perspectives of Artificial Intelligence in ColonoscopyJ Clin Med. 2022 May; 11(10): 2923.

Johns Hopkins Smart Tissue Autonomous Robot





https://www.youtube.com/watch?v=cybRmhsvOss, published on 28 Jan, 2022

Expanding area

- Radiomics for Diagnosing Lateral Pelvic Lymph Nodes in Rectal Cancer: Artificial Intelligence Enabling Precision Medicine?
- Development of Artificial Intelligence for Parathyroid Recognition During Endoscopic Thyroid Surgery
- Using Artificial Intelligence to Find the Optimal Margin Width in Hepatectomy for Colorectal Cancer Liver Metastases
- …

Conclusion

AI is used as tool for an easier and more precise identification of the structures

AI is currently perceived as a supplement and not a replacement for the skill of a human surgeon.

The future of autonomous surgery is there