

Background

Age plays a central role for curative treatment options in Oesophageal Cancer (OC).

Machine learning (ML) can learn detailed relationships between clinical variables and the probability of these treatments

SO...

Can ML map the influence age exerts on curative OC treatment decisions?

Objectives

399 post-oesophagectomy cases between 2010-2020 at University Hospital Southampton with 19 pre-treatment variables

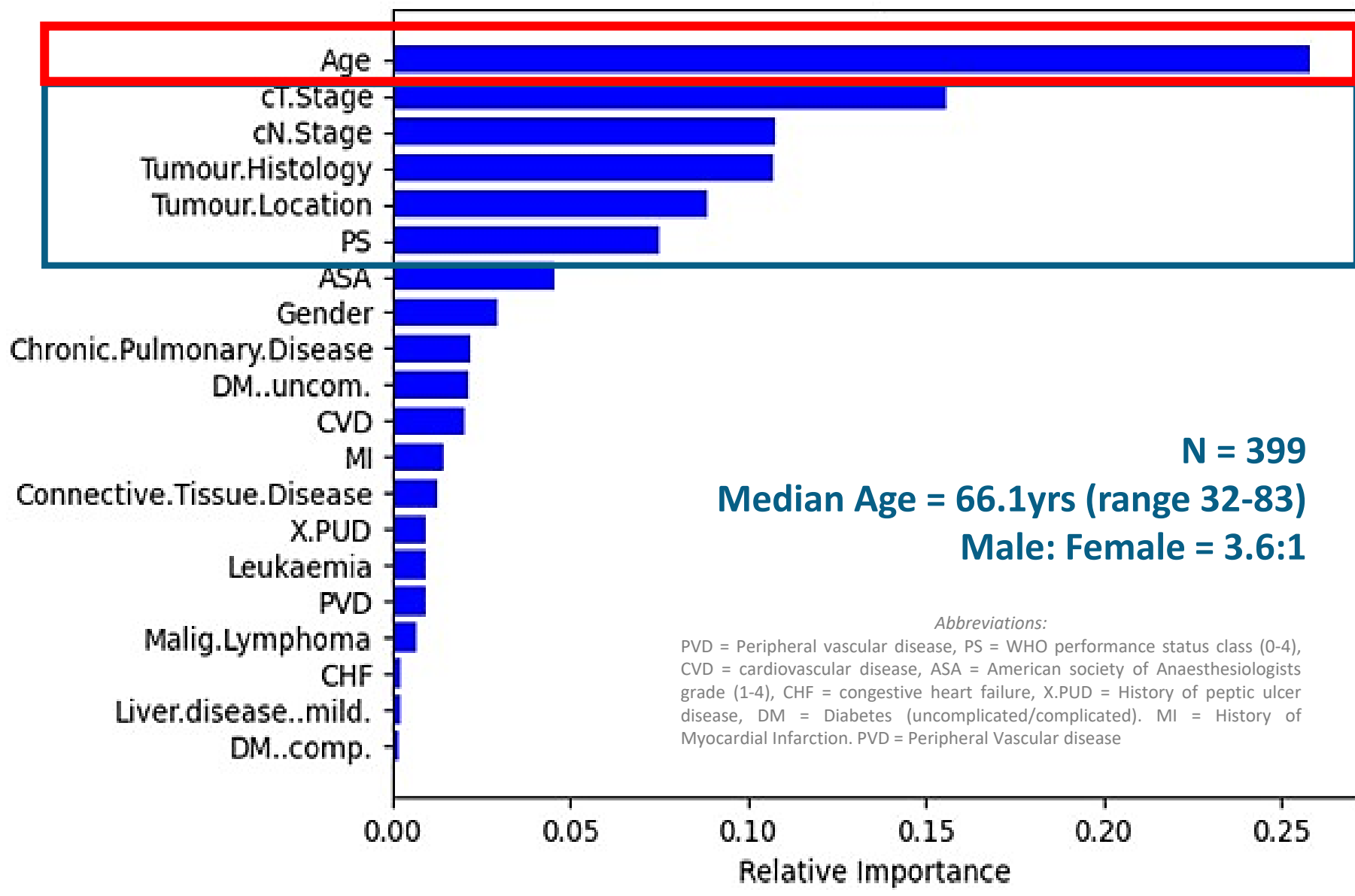
Random Forests model (Python) to classify predicted curative treatment: Surgery, Neoadjuvant Chemotherapy (NACT) + Surgery or Neoadjuvant CRT (NACRT) + Surgery as decided at MDT

Methodology

Variable Importance and Partial Dependence Analysis (PD) used to quantify importance of Age in decision-making and its relationship to the nearest most important factors

Results

Variable importance for random forests model

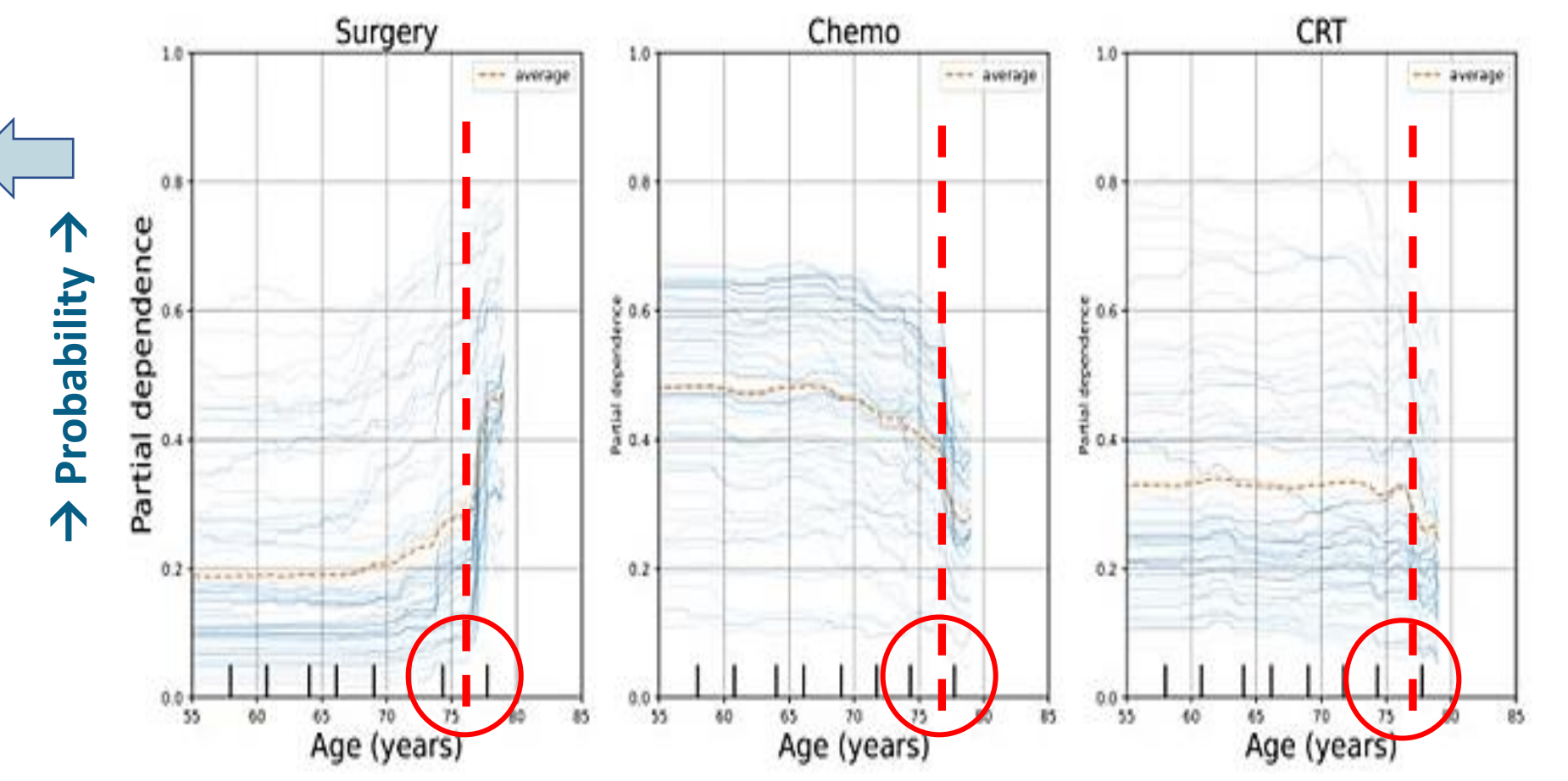


Age is highly important on Variable Importance Analysis (26% of total importance) for curative OC treatment decisions

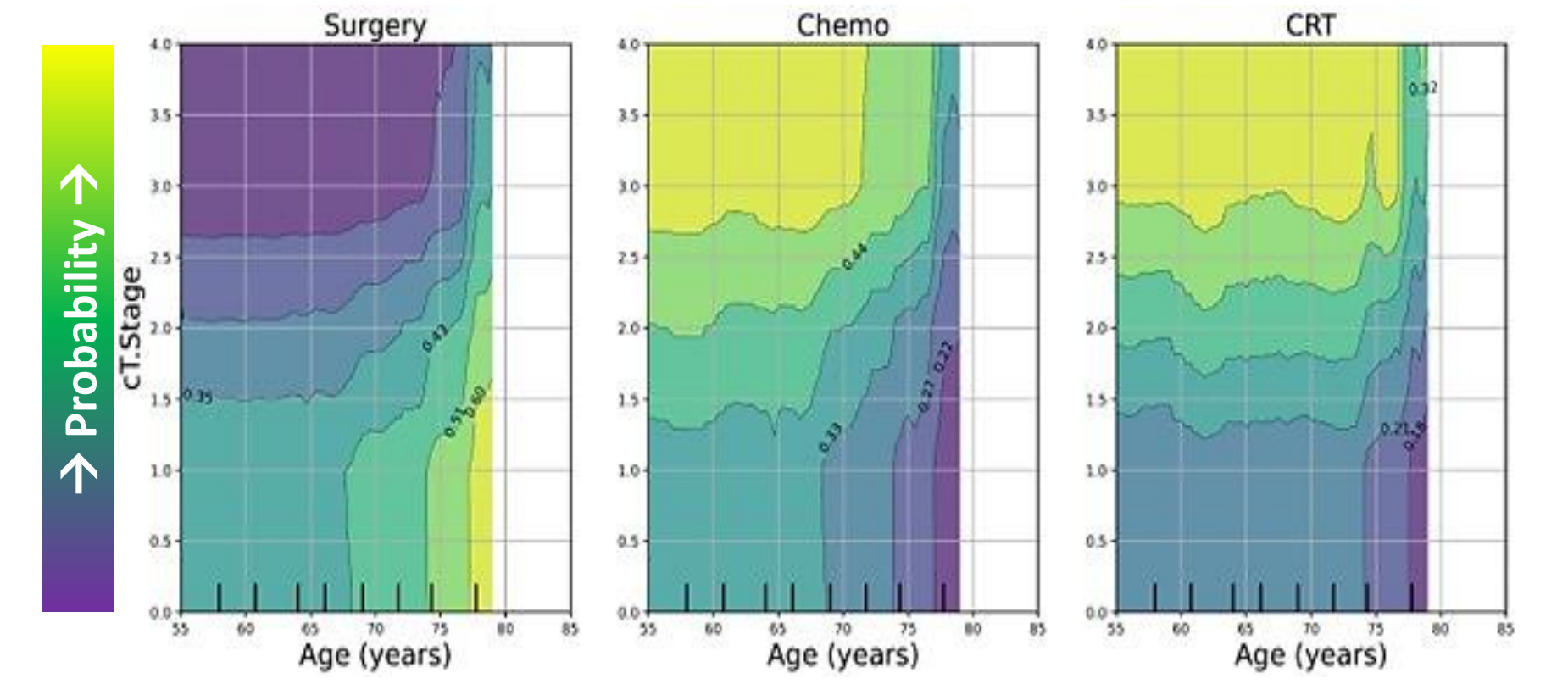
When patients enter their 70s the predicted probability of receiving Surgery alone rises while NACT+S falls. NACRT+S relatively unaffected

The next five most important factors were then analysed against Age

Influence of Age alone on curative OC treatment decisions

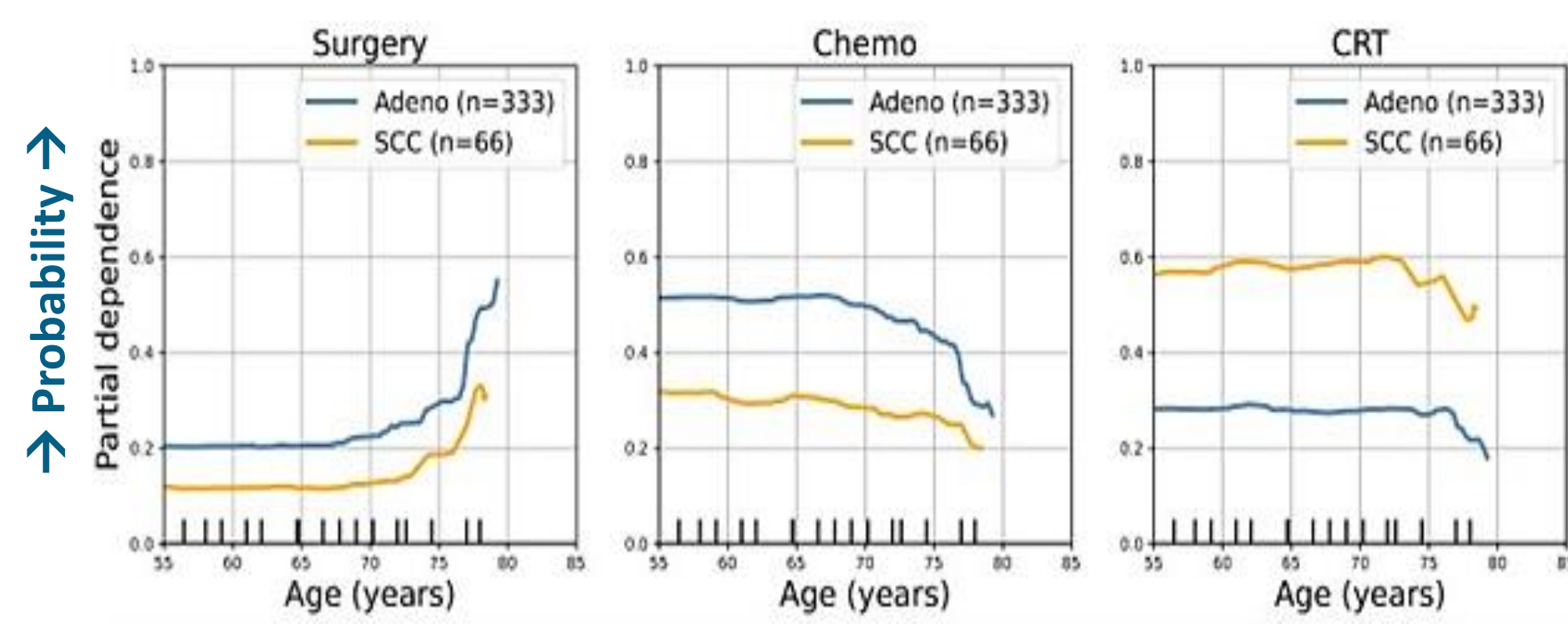


Age vs cT stage



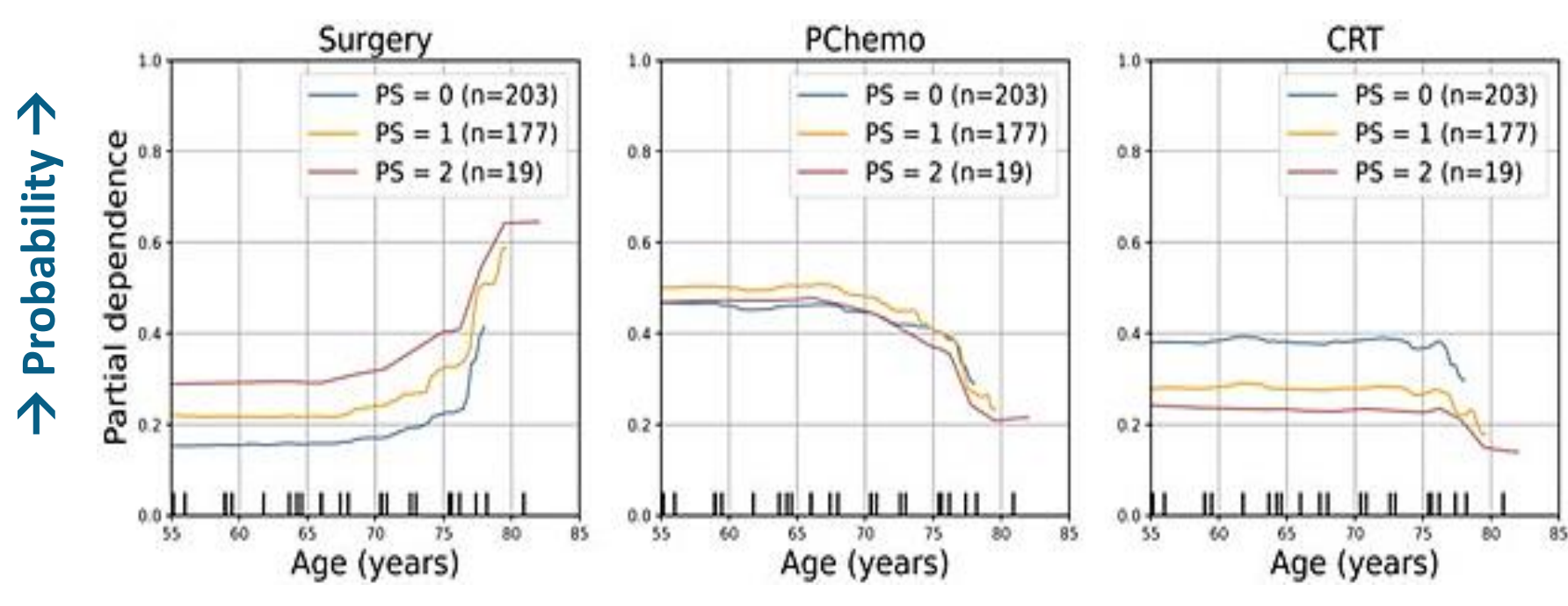
< 70 yrs, decisions driven by cT stage for Surgery alone and NACT +S while > 70 yrs Age drives decisions. NACRT+S largely unaffected by age until late 70s

Age vs Tumour Histology



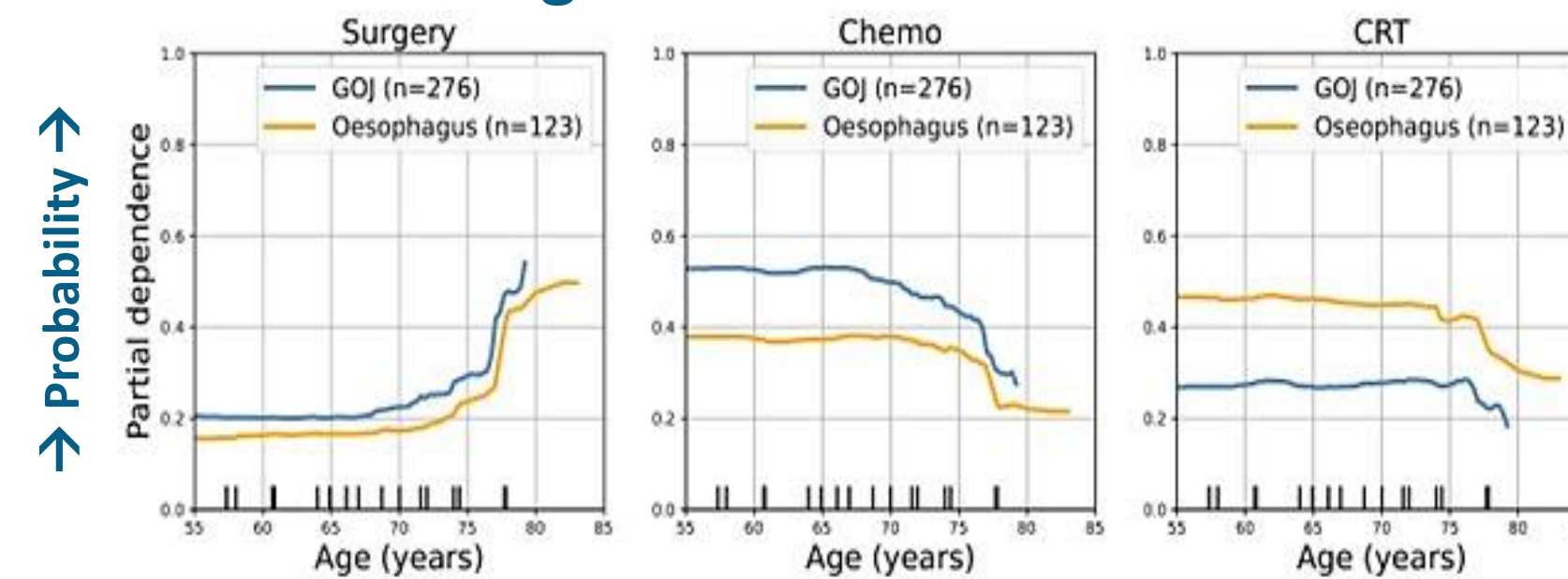
Histology influences choice of NAT independent of age (NACRT ↑ in SCC, NACT ↑ in Adeno). >70, Age drives up base probability of Surgery and away from NAT

Age vs Performance Status



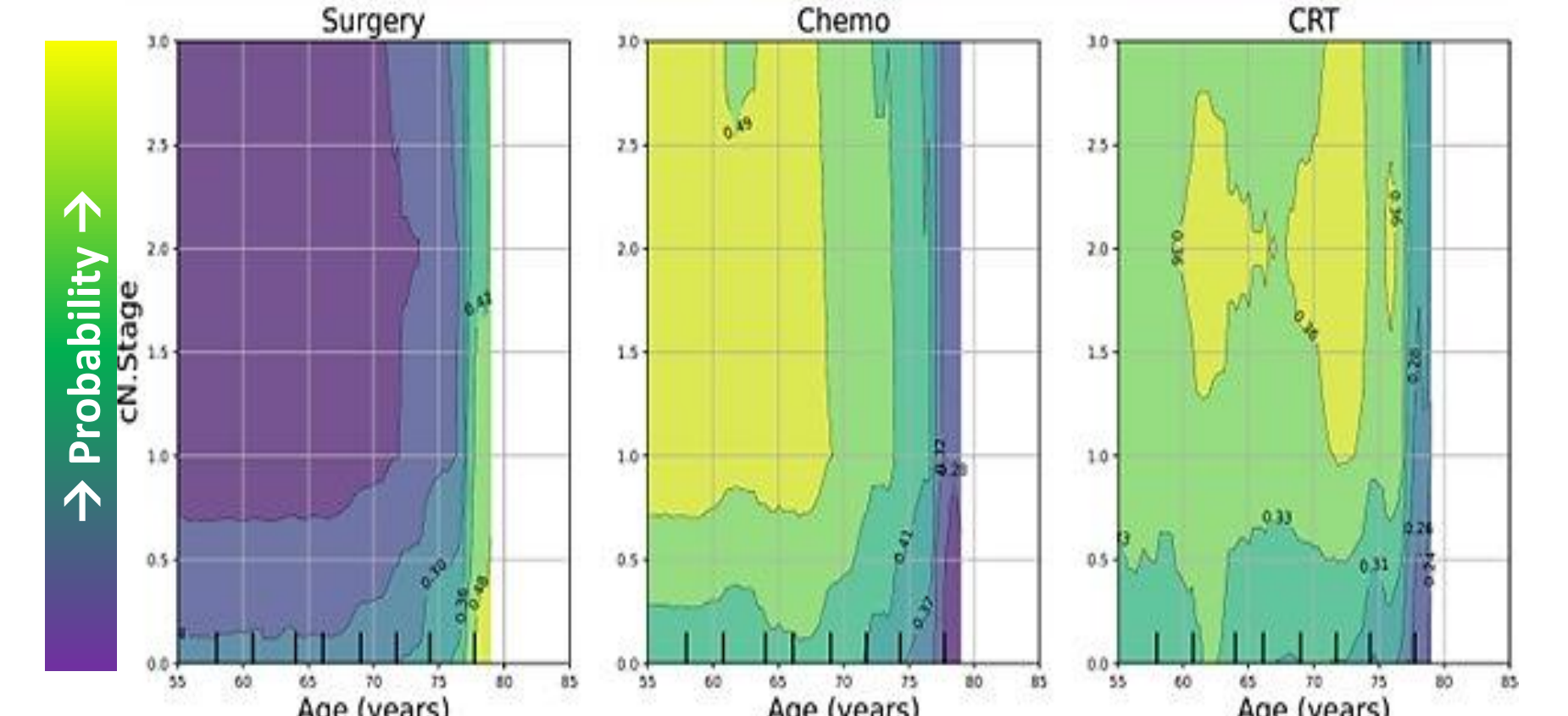
When < 70 Higher PS scores ↑ chance of Surgery, ↓ NACRT, minimal effect on NACT. > 70 Age synergises PS scores on probability of Surgery/NACRT and ↓NACT

Age vs Tumour Location



Location influences choice of NAT independent of age (NACRT ↑ in oesophageal tumours, NACT ↑ in GOJ tumours). > 70, Age drives up base probability of Surgery and away from NAT

Age vs cN stage



When < 70 decisions again driven by cN stage for Surgery and NACT, versus when > 70 where Age drove decisions. More complex relationship for NACRT

Conclusions



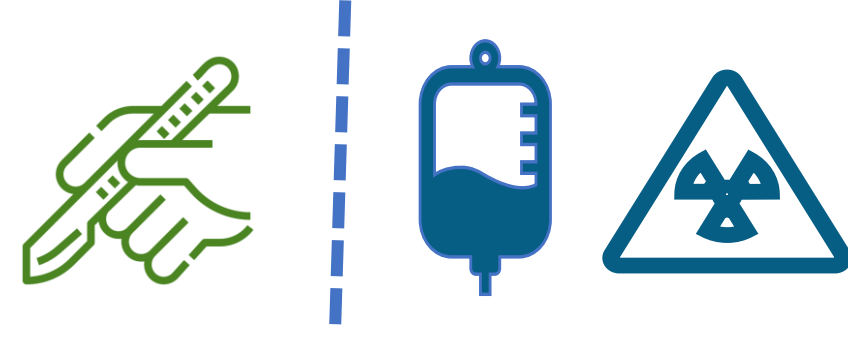
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Age remains a crucial factor in choosing curative treatment options for OC



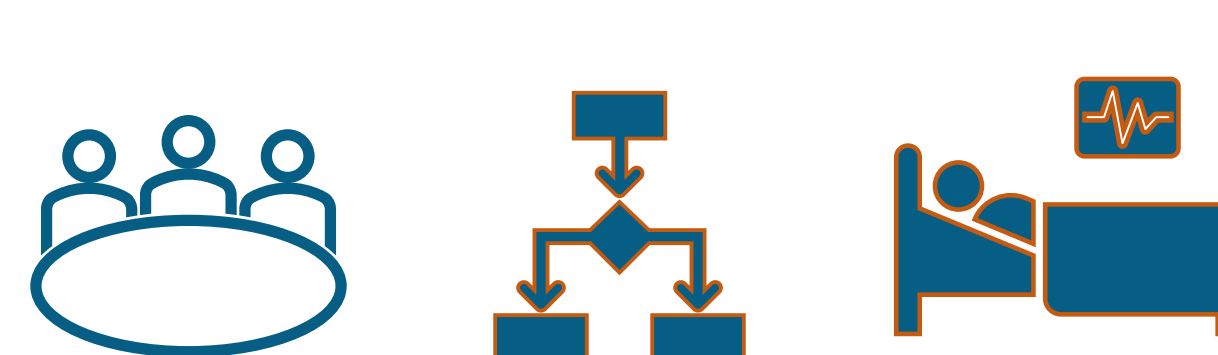
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A clear shift in predicted probability occurs in the 7<sup>th</sup> decade of life – with advanced Age even driving decisions over traditional staging parameters



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This influence varies across treatment modalities – advanced age increases probability of surgery alone but negatively impacts probability of receiving NAT, especially NACT



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This study is a novel use within OC of ML techniques to precisely map shifts in predicted probabilities for curative treatment decisions. It offers proof-of-concept that ML can provide data-driven insight into human-decision making in oncological settings.

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