COMMON PATTERNS OF VARIATION BETWEEN FEMORAL AND TIBIAL CARTILAGE MAPS AND BASELINE FEATURES FROM THE OSTEOARTHRITIS INITIATIVE

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INTRODUCTION

Artificial intelligence can merge knee MRI slices into "thickness maps" that contain clinically important patterns of variation.

METHODS

- In this analysis, we care about three blocks of data:
  1. Femoral cartilage maps
  2. Tibial cartilage maps
  3. Clinical/demographic variables
- We use **AJIVE** (Angle-based Joint and Individual Variation Explained) to uncover **modes of variation** that are shared among the blocks.
- AJIVE returns the modes of variation in terms of :
  - **scores**, which say how much each knee expresses each mode
  - **weights**, which say the combinations of input variables that define those modes
- The scores and weights drive the interpretations of the AJIVE results.

CONCLUSIONS

- We found 3 statistically significant shared modes of variation
- They are interpretable: (1) is a term for overall thickness, (2) a term for medial dominant thinning, (3) a term for dialing in medial/lateral cartilage loss.

ACKNOWLEDGEMENTS

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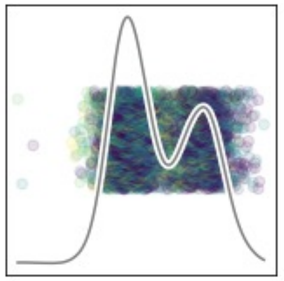
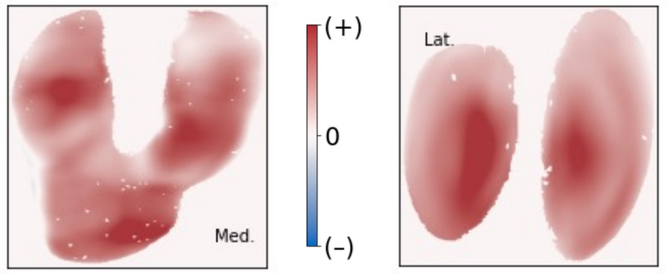
MODE 1

KNEE SCORES



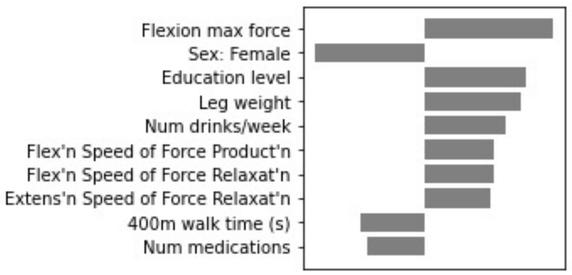
Bimodal pattern: women tend to have negative Mode 1 scores, men positive

FEMORAL LOCATION WEIGHTS **TIBIAL LOCATION WEIGHTS**



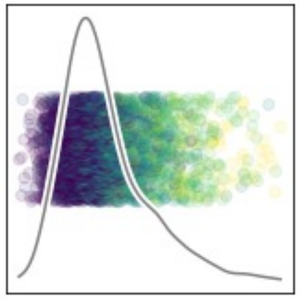
Weights tell us how to interpret a large positive score. Here, the overall red heatmaps indicate that knees with positive Mode 1 scores (mostly men) have thicker cartilage all around.

CLINICAL/DEMO WEIGHTS

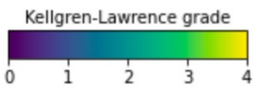


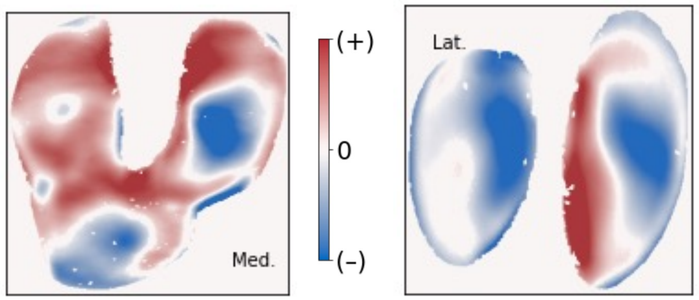
The thicker cartilage is associated with larger force measures and male sex.

MODE 2

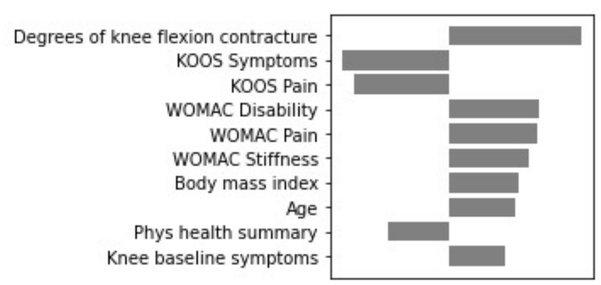


Mode 2 scores have a right tail, associated with KL grade:



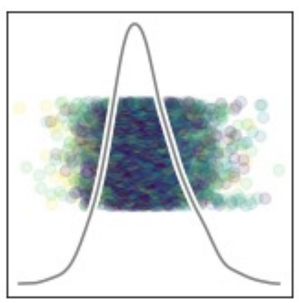


Blue regions tell us where knees with high Mode 2 experience thinning: thinner medial relative to lateral cartilage, and thinner tibial relative to femoral.

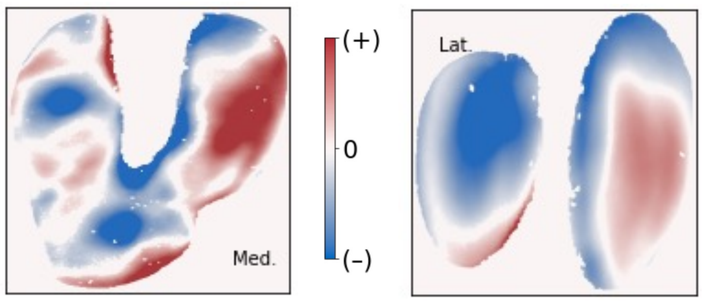


Knees expressing Mode 2 strongly also tend to be older, higher BMI, poorer physical health, more symptoms.

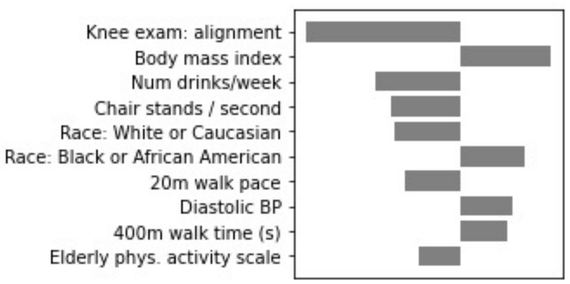
MODE 3



Mode 3 has symmetric distribution with one peak, and is not associated with KL grade.



Knees with positive Mode 3 have thinner lateral cartilage relative to medial, while negative Mode 3 displays the reverse.



Positive Mode 3 is associated with valgus alignment, higher BMI, and is somewhat associated with Black race.