LREC-COLING 2024

**The Key Points:** Using feature importance to identify shortcomings in sign language recognition models

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LERO Software for a better world

SIGNON

Horizon 2020
European Union Funding
for Research & Innovation

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IMAGES & VIDEOS OF SIGNING

PREPROCESSING

MODEL TRAINING

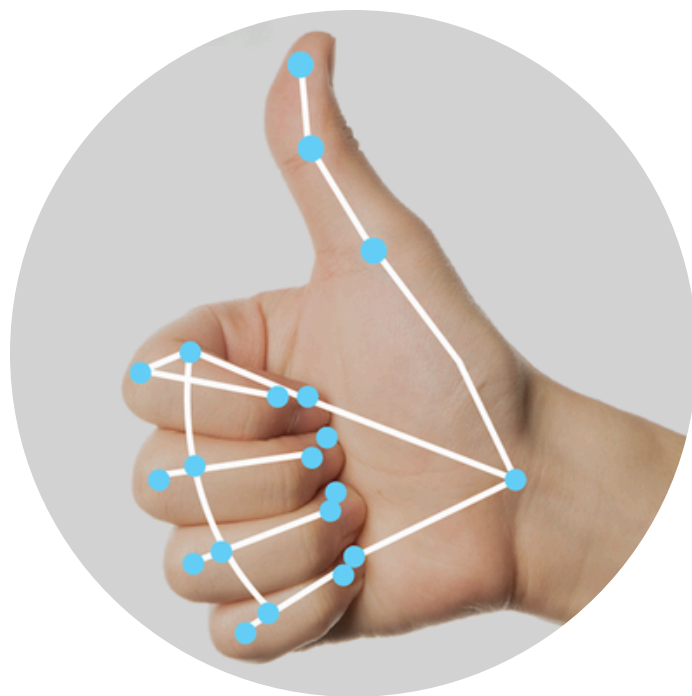SIGN CLASSIFICATION?

# SIGN LANGUAGE RECOGNITION

In the field of Computational Linguistics, Sign Language Recognition (SLR) sits at the intersection of Computer Vision and Natural Language Processing.

## DATA-BASED CHALLENGES:

- Complex visual modality
- Scarcity
- Lack of diversity

# POSE-ESTIMATION TOOLS

Reliable means of detecting the salient parts of the body - termed **keypoints.**

Google. (2023). *Hand gesture*. MediaPipe | Google for Developers. https://developers.google.com/mediapipe
Google. (2023). *Pose detector*. MediaPipe | Google for Developers. https://developers.google.com/mediapipe

## DIMENSIONALITY

Keypoints offer a structured input representation and a significantly reduced dimensionality compared to visual data.

## VISUAL CONDITIONS

Extensive training and diverse data enhances our ability to cope with different visual conditions such as lighting and background scenery.

## HUMAN VARIATION

This also better equips us for signer variation and limits the personal characteristics learnable by subsequent SLR models.

IMAGES & VIDEOS OF SIGNING

PREPROCESSING

MODEL TRAINING

SIGN CLASSIFICATION?

|  | kp0 | kp1 | ... | kpm |
|---|---|---|---|---|
| t0 | | | | |
| t1 | | | | |
| t2 | | | | |
| t3 | | | | |
| t4 | | | | |
| t5 | | | | |
| ... | | | | |
| tn | | | | |

Google. (2023). *Hand gesture*. MediaPipe | Google for Developers. https://developers.google.com/mediapipe
Google. (2023). *Pose detector*. MediaPipe | Google for Developers. https://developers.google.com/mediapipe

# DATA - CORPUS VGT

FLEMISH SIGN LANGUAGE
(VLAAMSE GEBARENTAAL, VGT).

Continuous signing videos processed into clips based on available gloss-tier annotations.

Stratified split to ensure similar class distribution in all subsets.

Grouped split to ensure signer-independent data configuration.

| TRAINING | VALIDATION | TEST |
| --- | --- | --- |
| 88 participants | 12 participants | 11 participants |
| 19,267 samples | 2,702 samples | 2,998 samples |
| 292 classes | 292 classes | 292 classes |
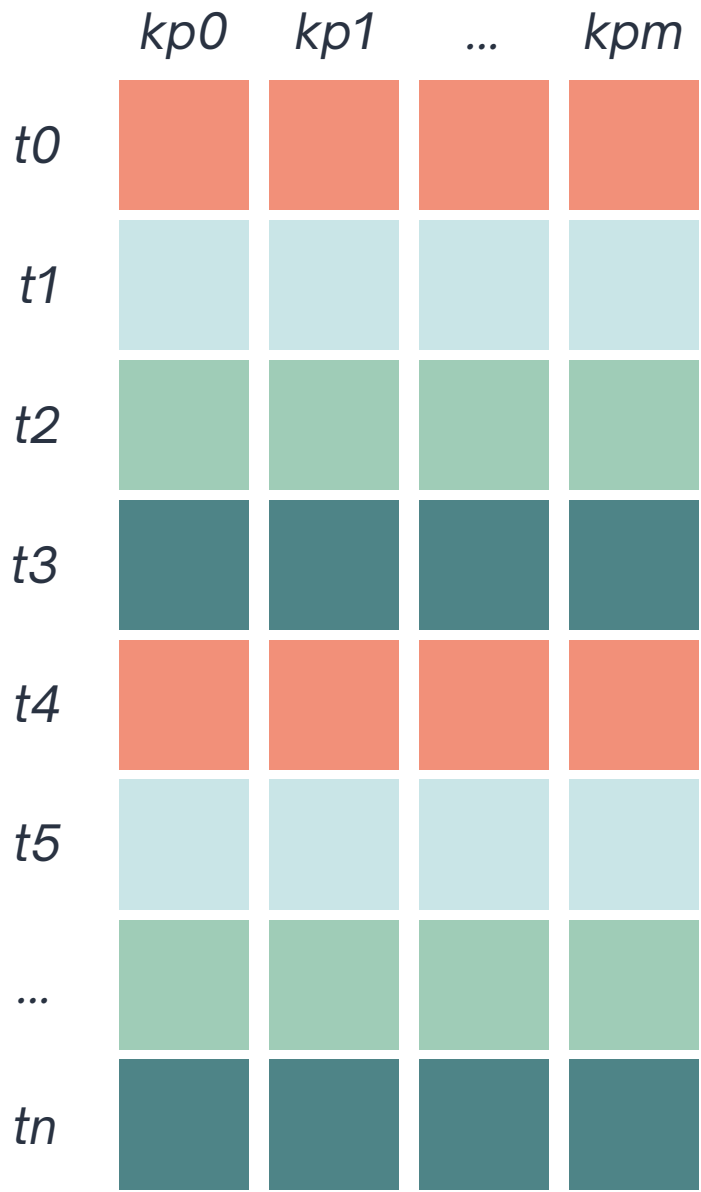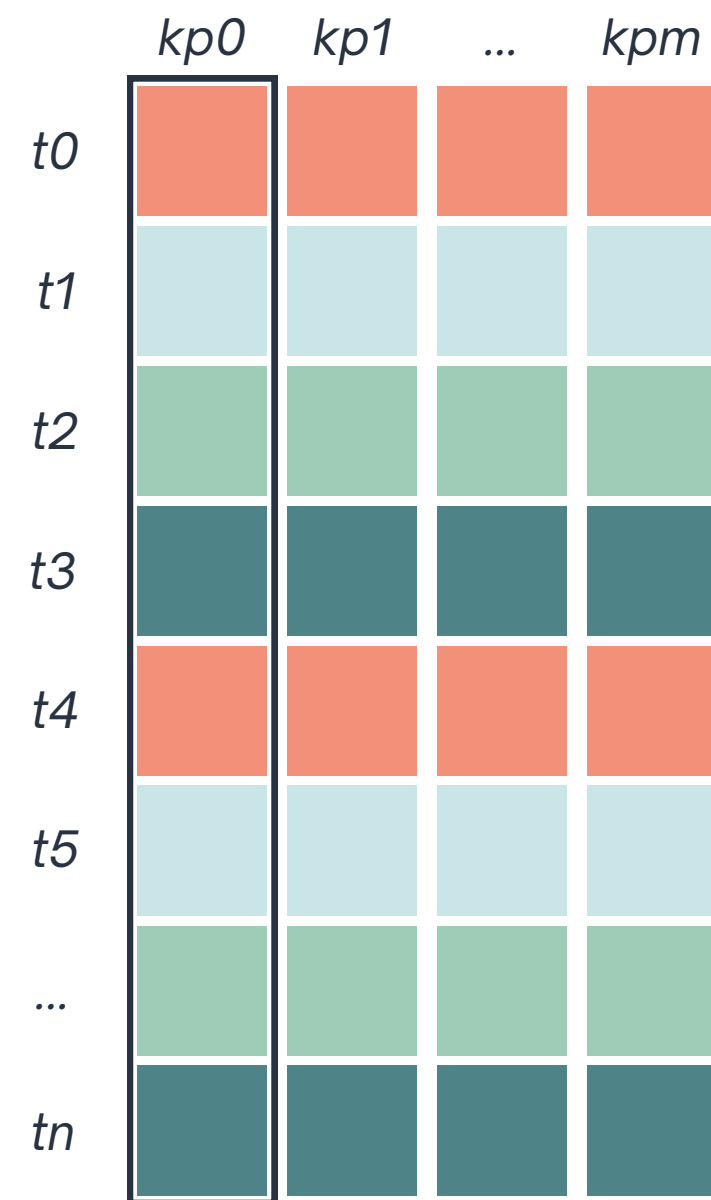
Mieke Van Herreweghe, Myriam Vermeerbergen, Eline Demey, Hannes De Durpel, Hilde Nyffels, and Sam Verstraete. 2015. Het Corpus VGT. Een digitaal open access corpus van videos and annotaties van Vlaamse Gebarentaal, ontwikkeldaan de Universiteit Gent ism KU Leuven. www.corpusvgt.be.

# PERMUTATION FEATURE IMPORTANCE

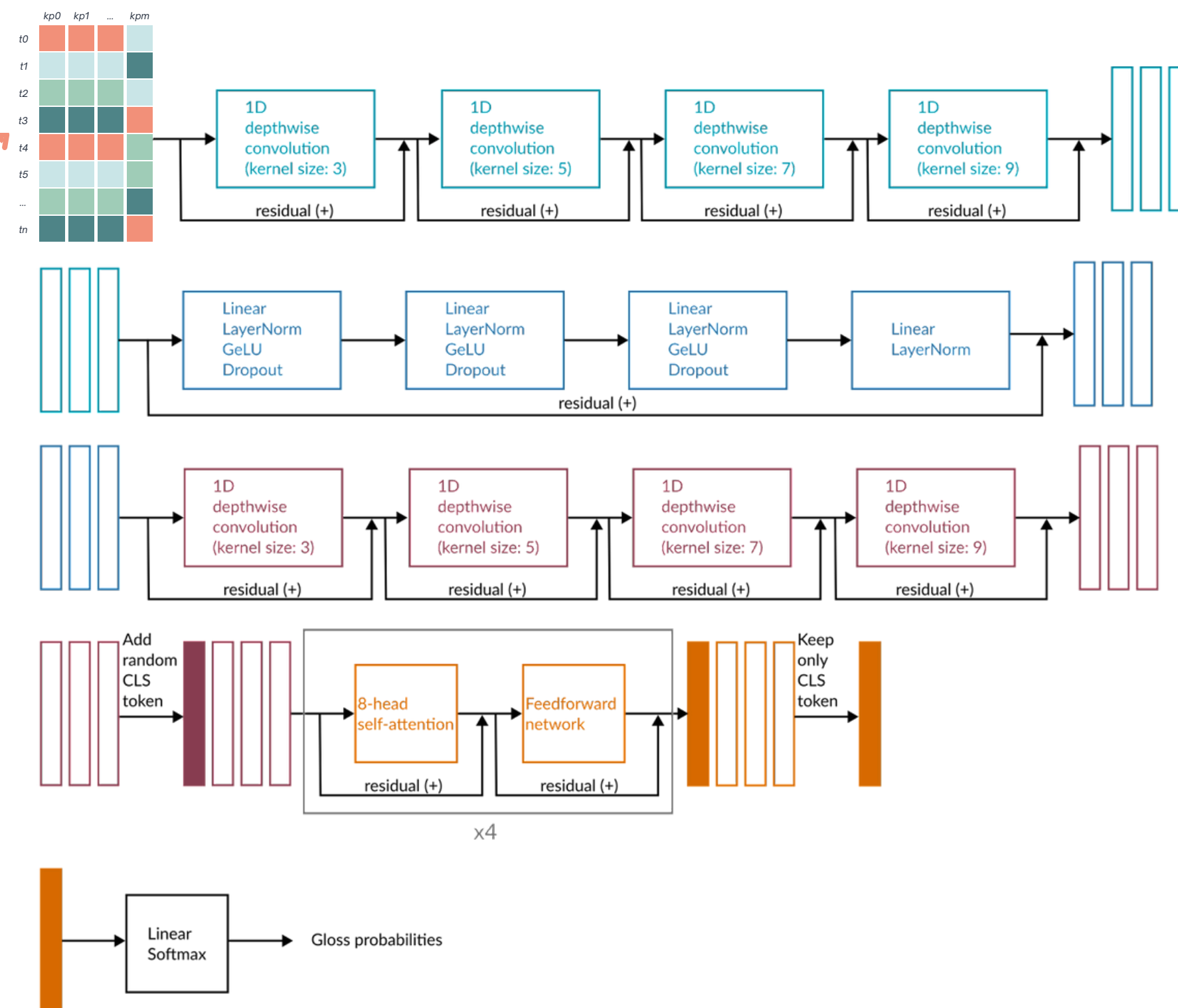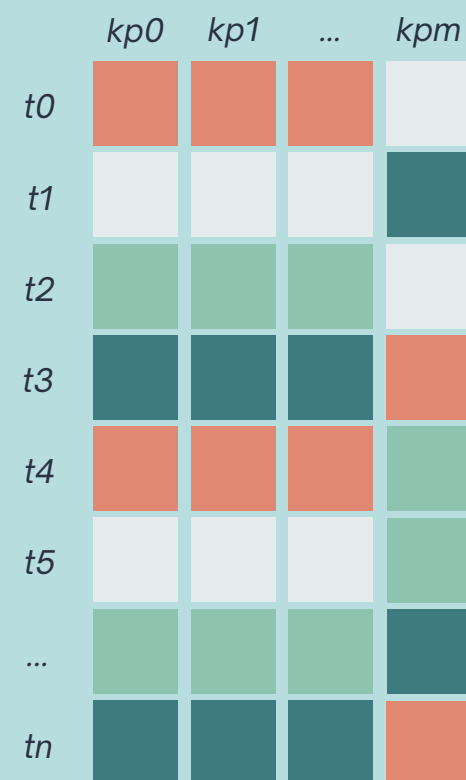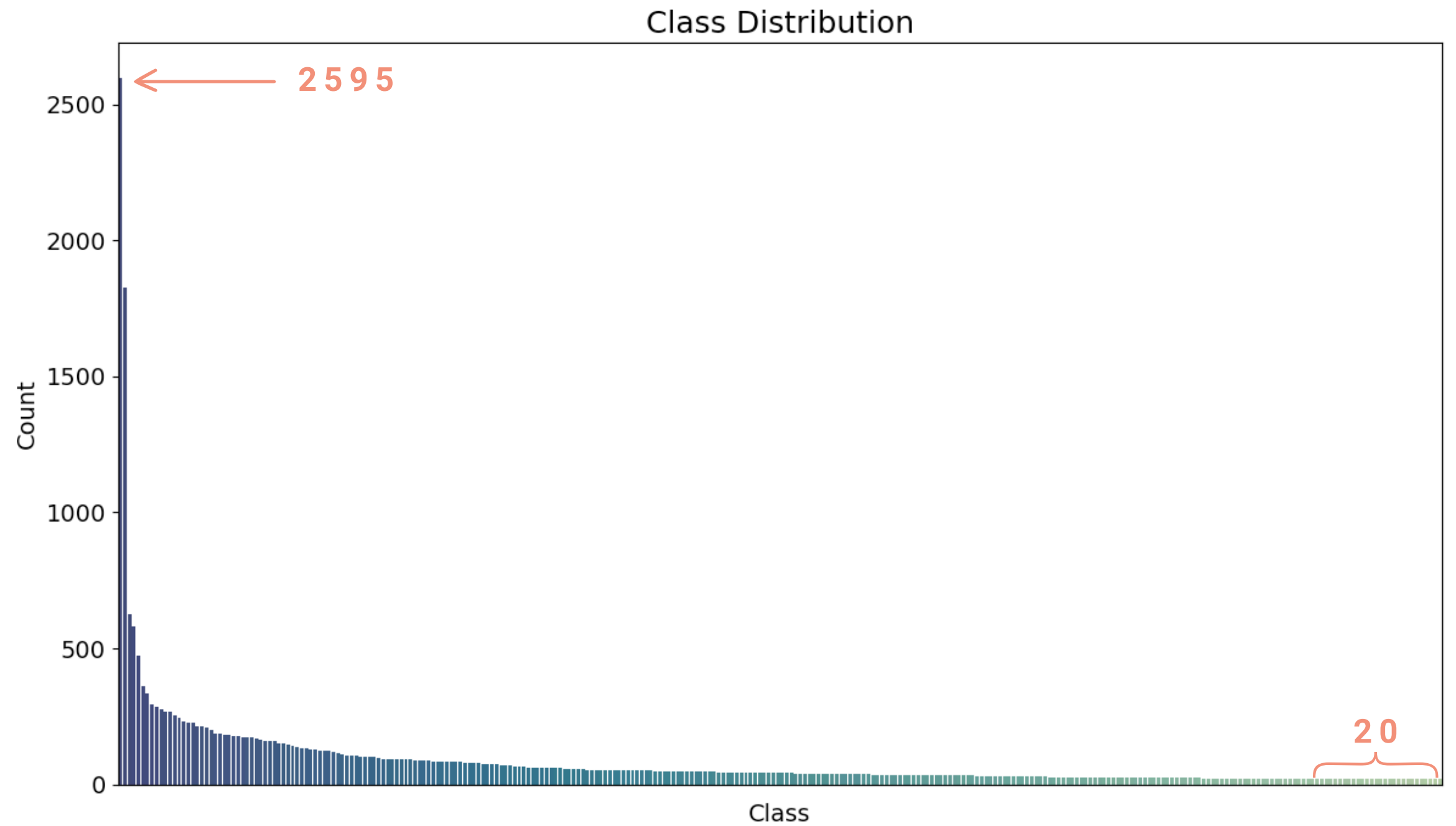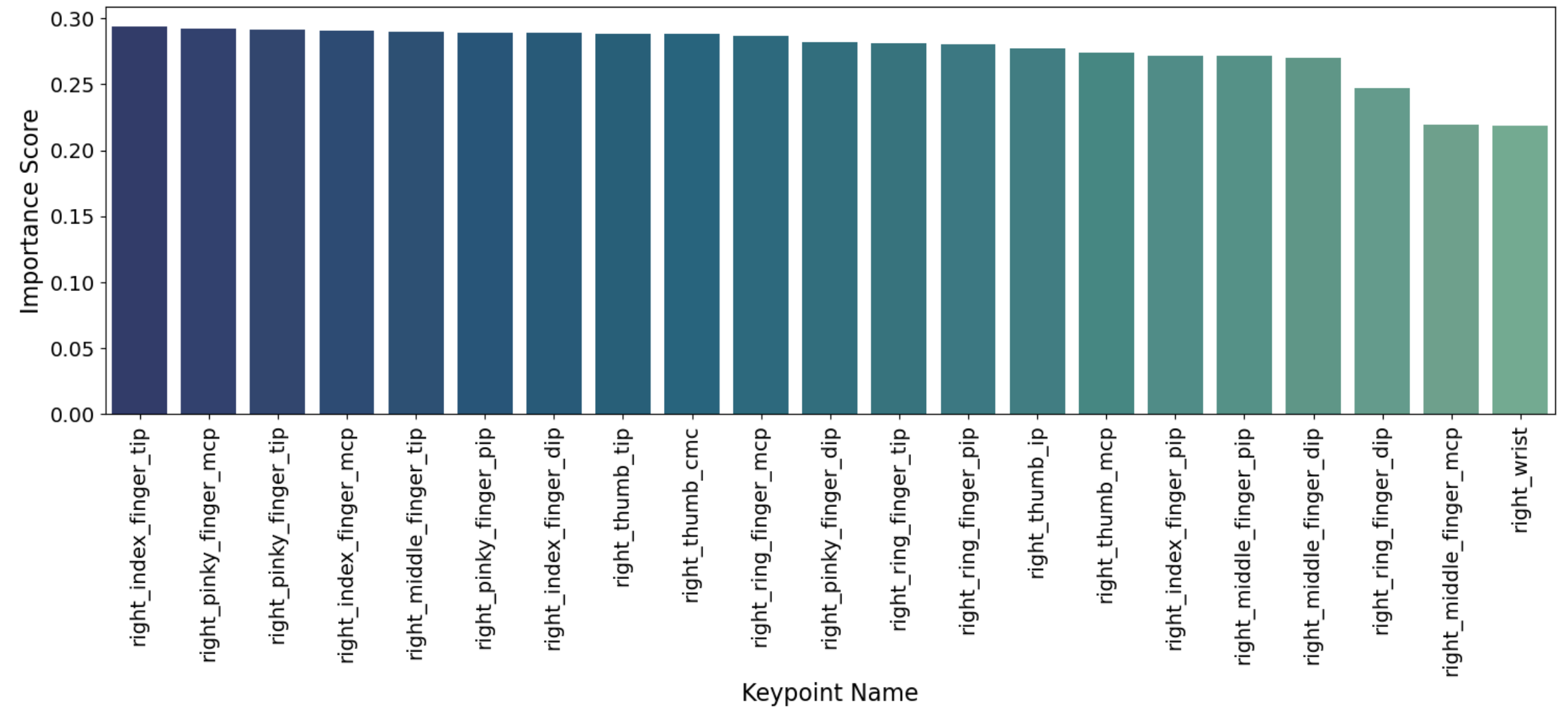# PERMUTATION FEATURE IMPORTANCE

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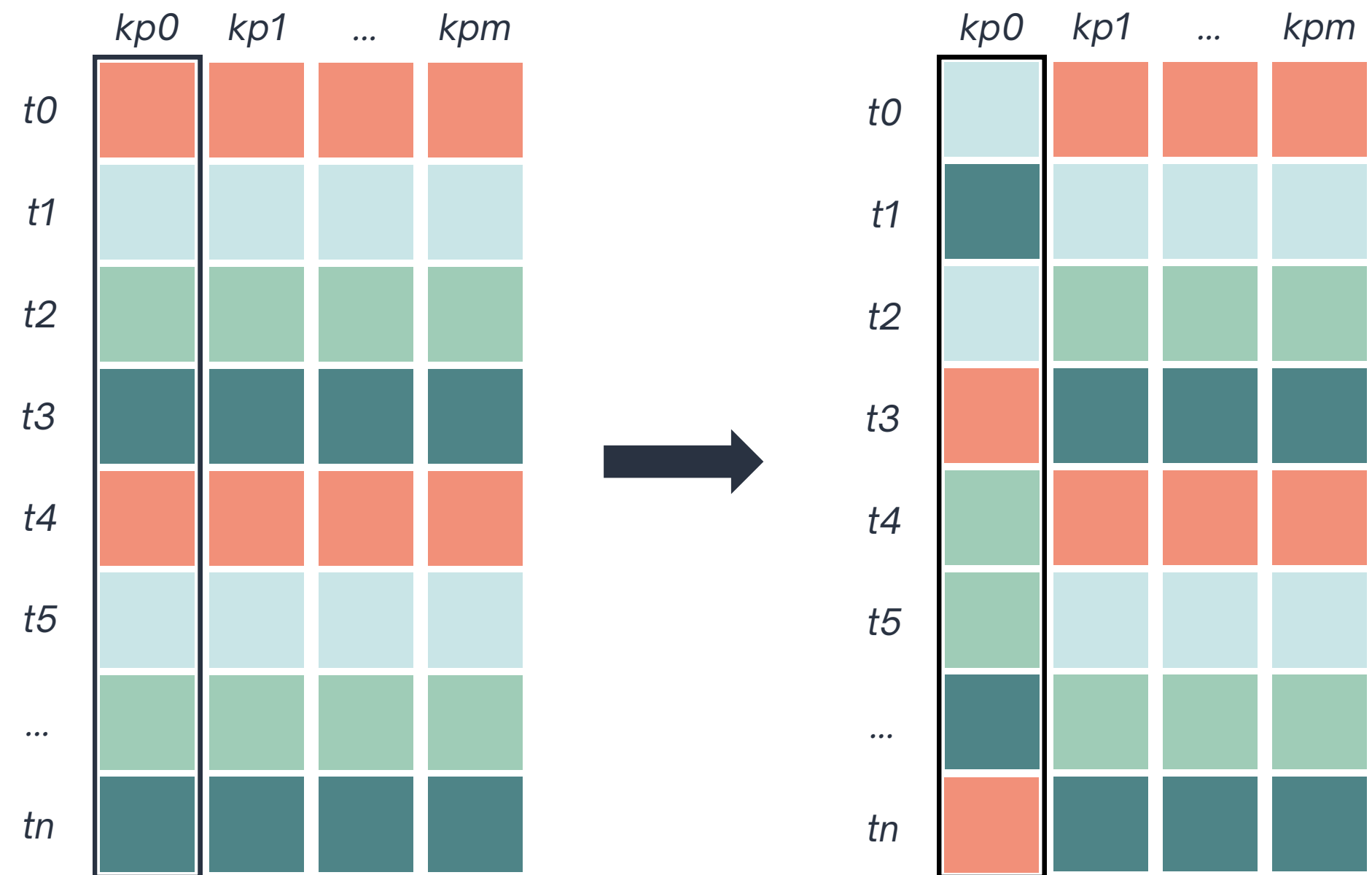
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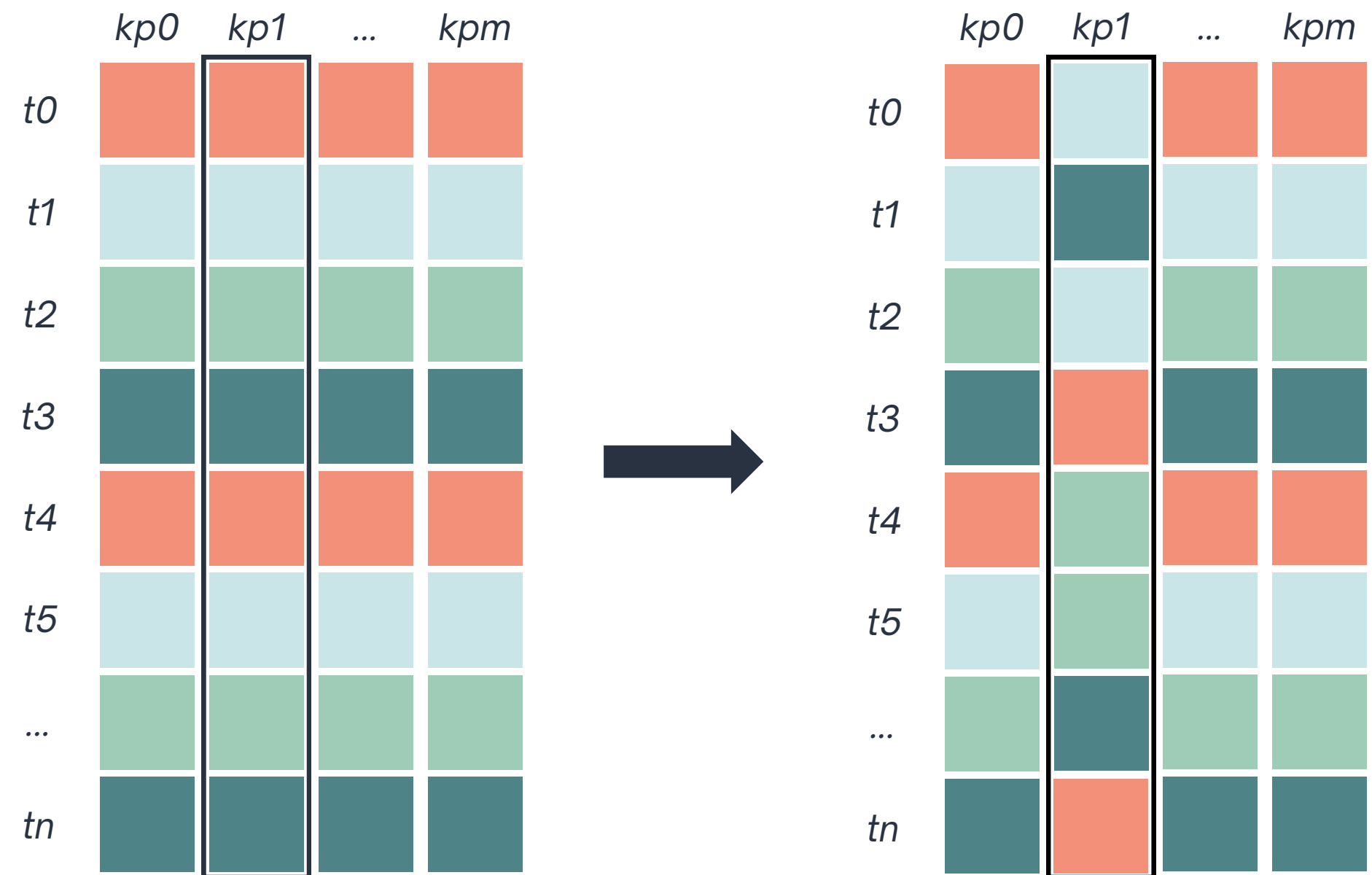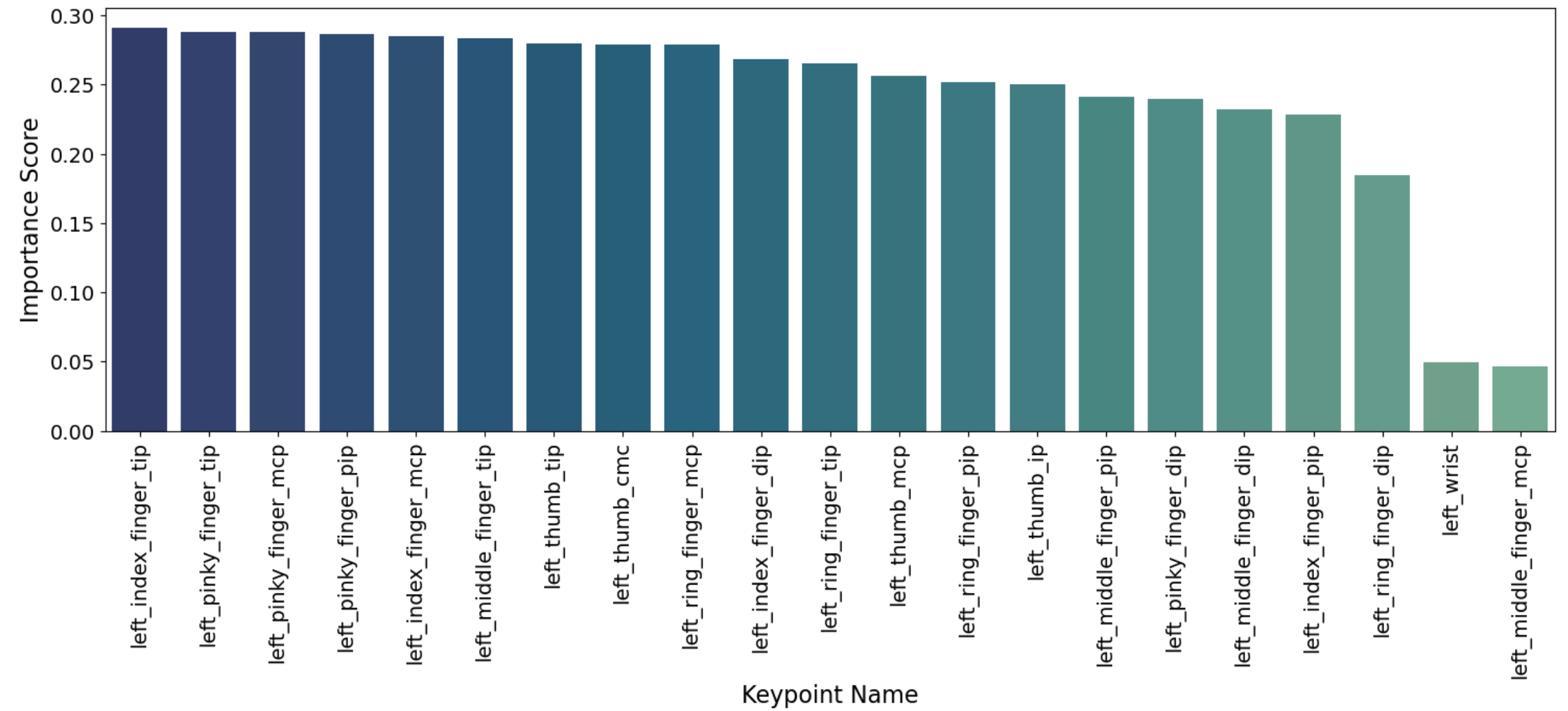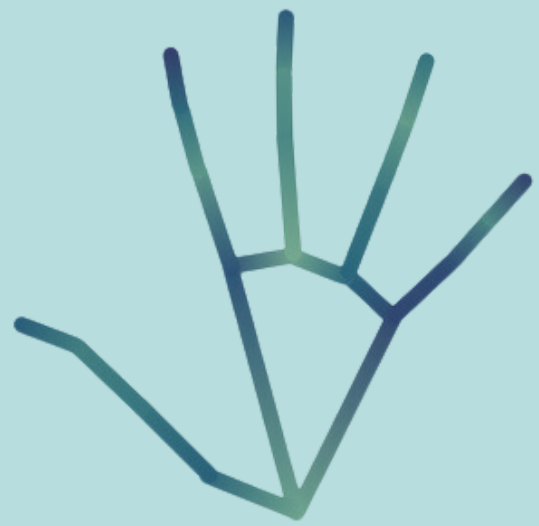
# PERMUTATION FEATURE IMPORTANCE
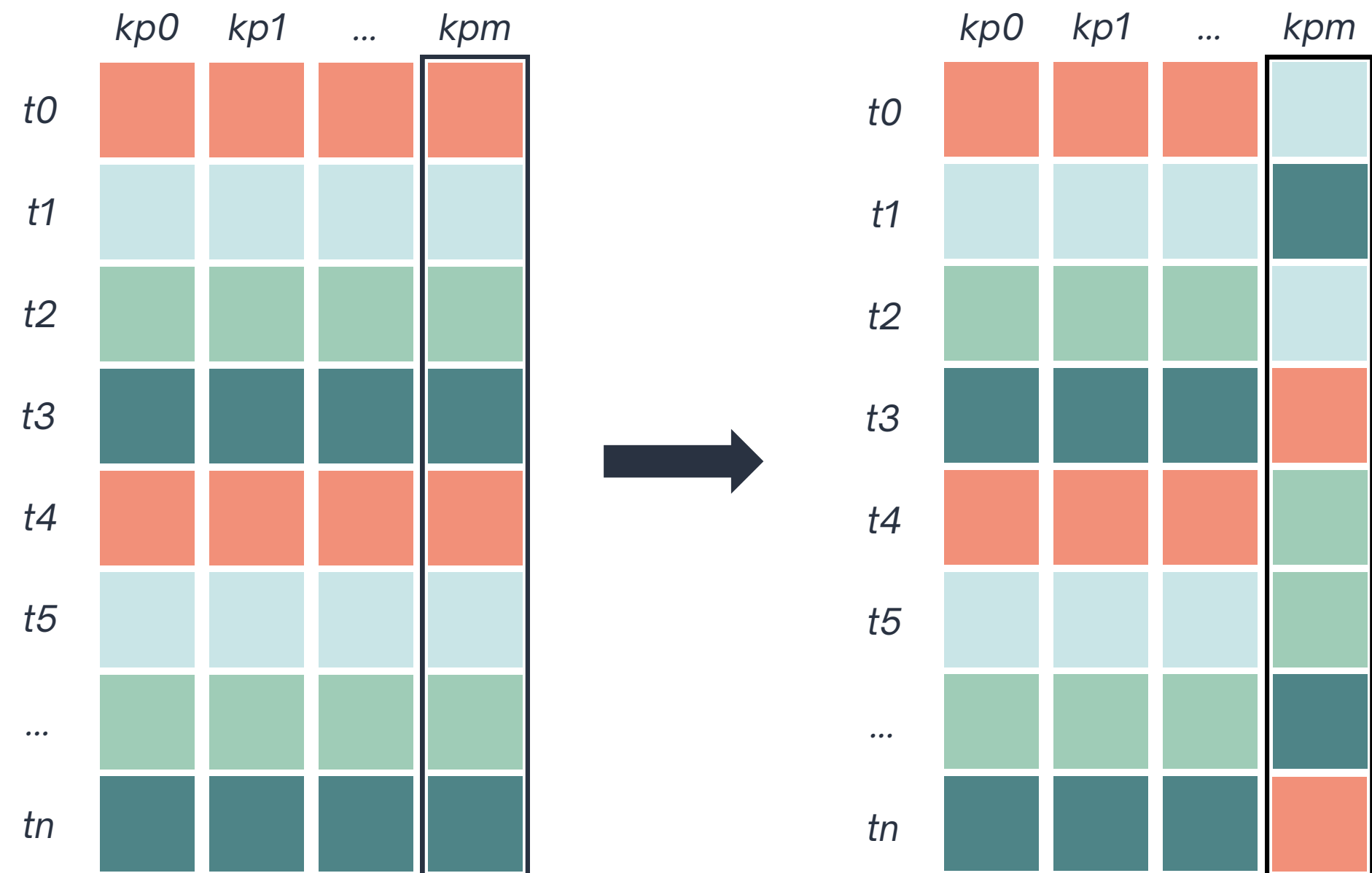
# MODEL

# CLASS IMBALANCE

# RIGHT HAND KEYPOINT IMPORTANCE

# LEFT HAND KEYPOINT IMPORTANCE

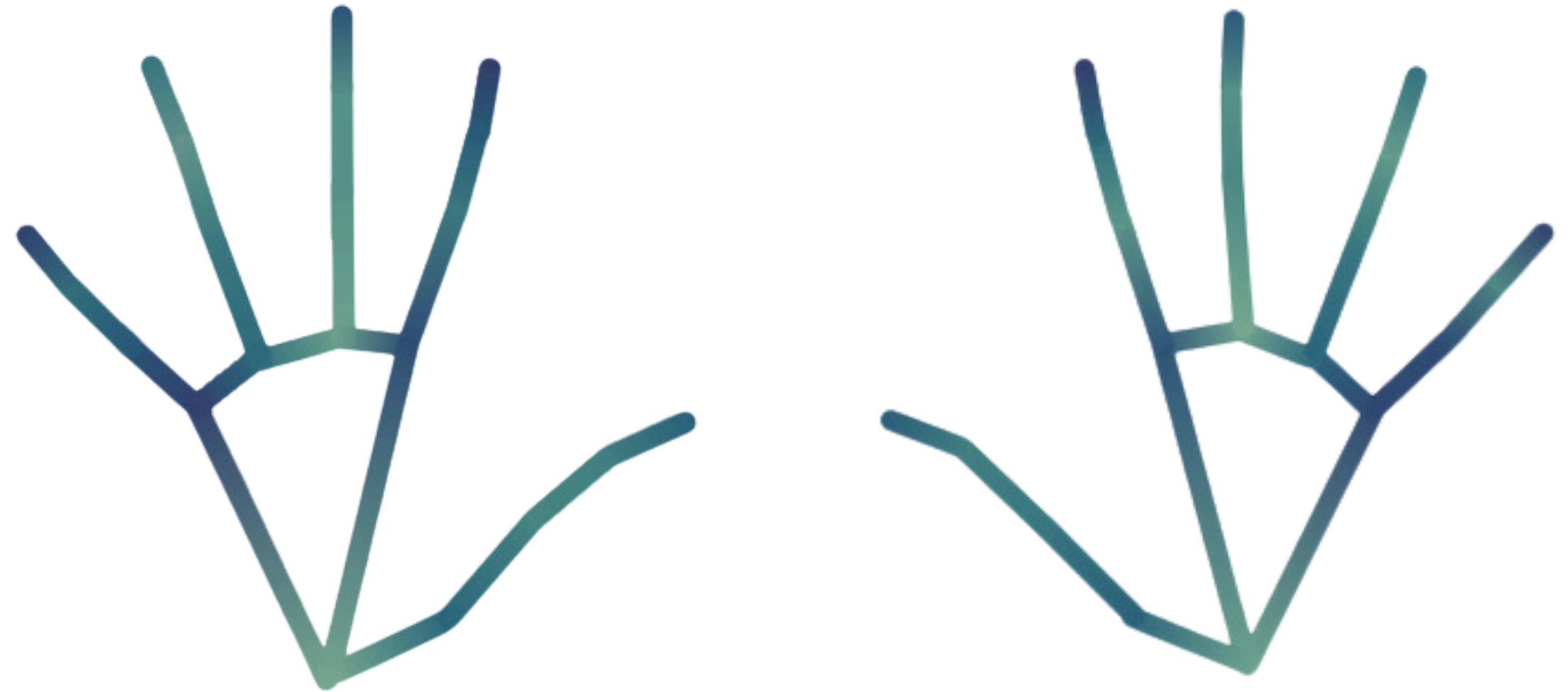# HAND KEYPOINT IMPORTANCE

**INNER FINGERS**

Higher level of occlusion due to their position.
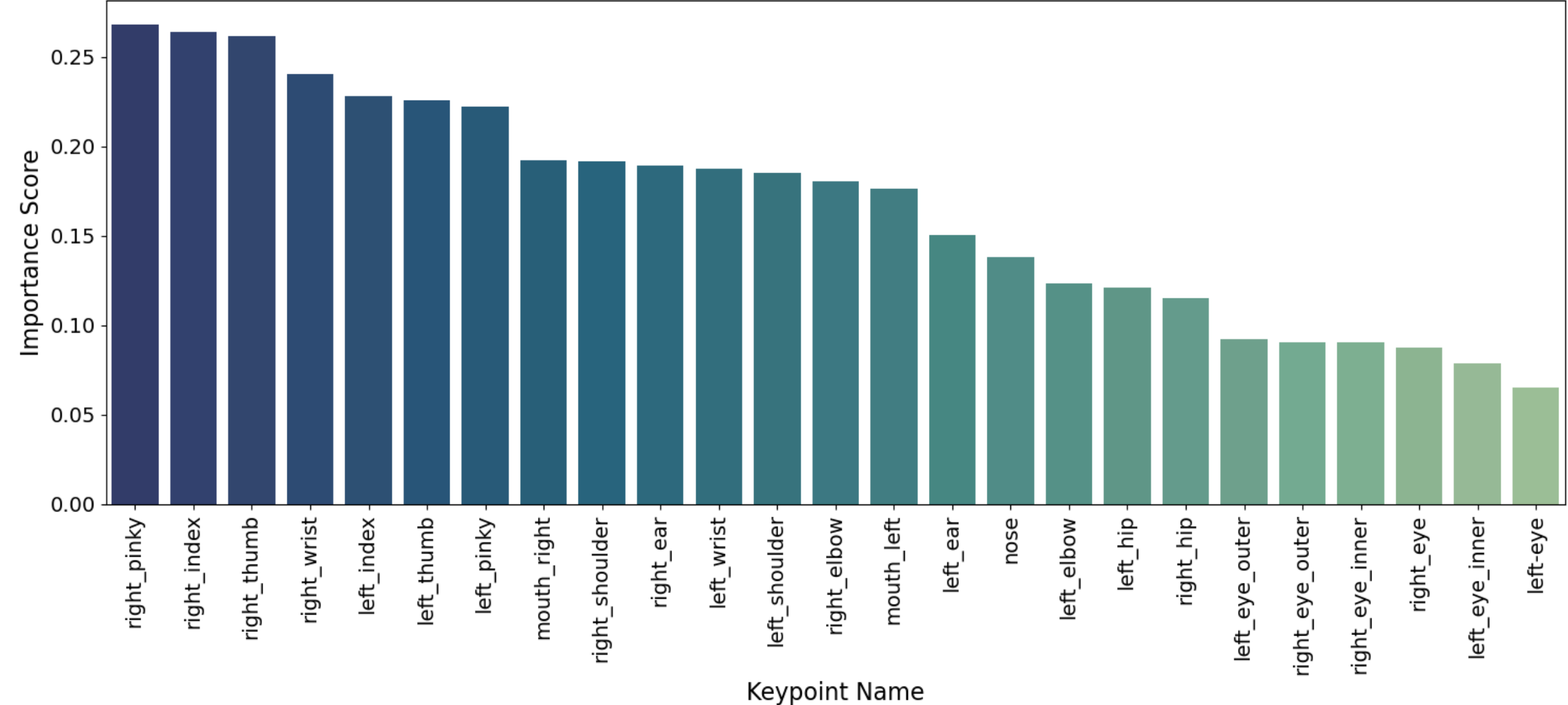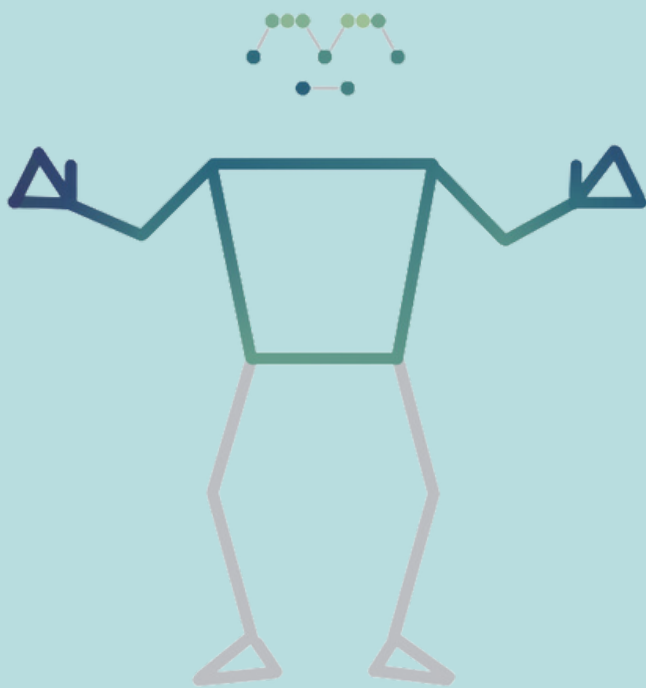
**INNER JOINTS**

Higher level of occlusion or lack of accurate depth information.
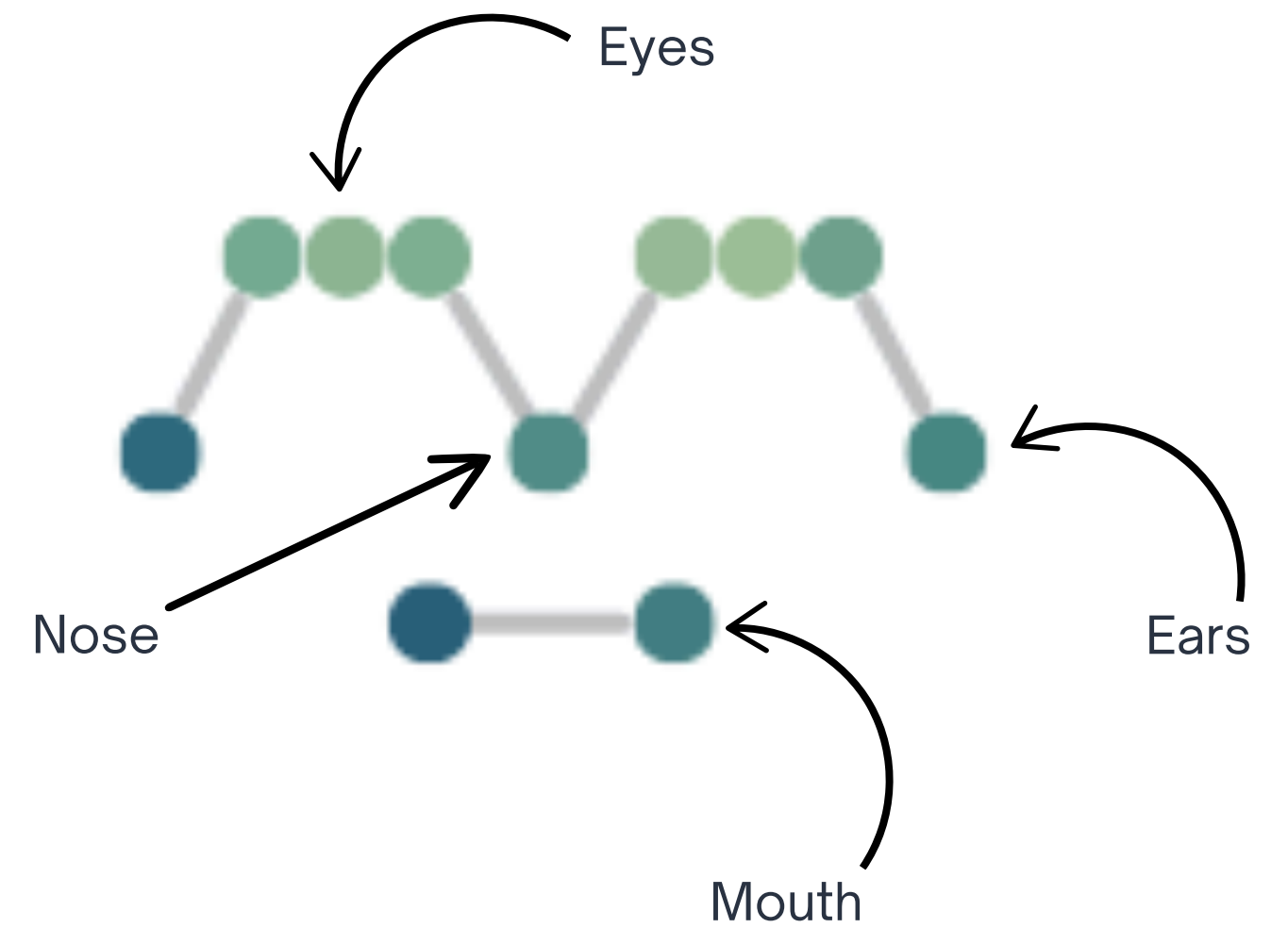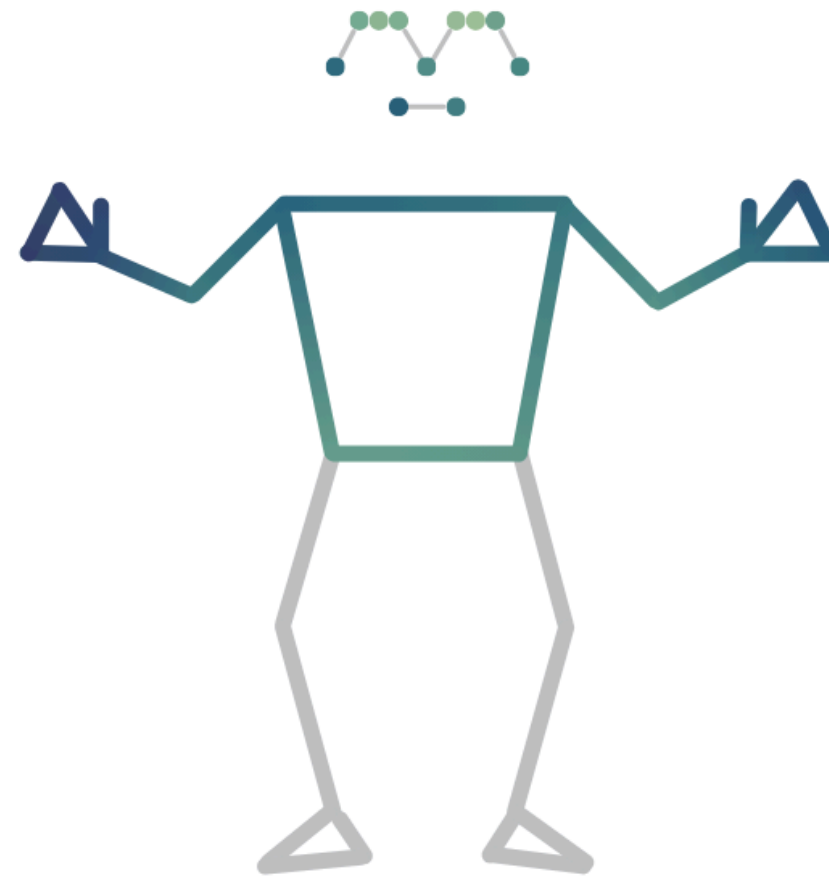
**VARYING IMPORTANCE**

Potential bias if not featured predominantly in a large number of signs.

# BODY KEYPOINT IMPORTANCE

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# KEY OBSERVATIONS

Keypoint distortion  *- occlusion and lack of accurate depth information.*

Gloss imbalance  *- over-reliance on keypoints prominent in large number of signs.*

Facial features  *- surprisingly under-utilised.*

Feature importance for feature selection  *- feature importance does not always equate to linguistic importance.*

# LIMITATIONS & FUTURE WORK

Single language dataset  *- expand to include additional datasets for more language-agnostic evaluation.*

Single SLR model architecture  *- additional models to reveal overlapping trends in feature utilisation.*

# THANK YOU