

0.Thesis

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Data structure

Action Unit across the Justices

Apart from understand how each Justice behaves consistently or not across all the videos, we are also interested in comparing *across* all the Justices to study who are more animated than others during the hearings. In this piece of analysis we perform a principle component analysis (PCA) on two set of variables. Variables in the form of AU**_r represents the intensity of each AU, which takes value from 0 to 5. The other set of variable: AU**_c represents the binary presence or not of each AU. Time index is averaged for each judge and video pair and mathmetically, it can be summarised as follows.

$$\begin{bmatrix} x_{1,1,\bar{t},1} & x_{1,1,\bar{t},2} & \cdots & x_{1,1,\bar{t},K} \\ x_{1,2,\bar{t},1} & x_{1,2,\bar{t},2} & \cdots & x_{1,2,\bar{t},K} \\ \vdots & \vdots & & \vdots \\ x_{1,J,\bar{t},1} & x_{1,J,\bar{t},2} & \cdots & x_{1,J,\bar{t},K} \\ x_{2,1,\bar{t},1} & x_{2,1,\bar{t},2} & \cdots & x_{2,1,\bar{t},K} \\ \vdots & \vdots & & \vdots \\ x_{I,J,\bar{t},1} & x_{I,J,\bar{t},2} & \cdots & x_{I,J,\bar{t},K} \end{bmatrix} \quad (1)$$

Result

The scree plot in Figure 1 shows that the cummulated variance explained by each prinicple component increases gradually. This

The variable plot in Figure 2 presents the loading of each variable in the first two components. The important variables are the ones with large loadings in the absoluate value and have been summarised into the following table.

PC#	Presence	Intensity
PC1	AU05_c, AU45_c	AU06_r, AU09_r,AU17_r, AU45_r
PC2	AU05_c, AU09_c,AU25_c	AU04_r, AU06_r, AU09_r, AU17_r

Visualisation of the first two PCs can be found in Figure 3. It shows that the Justices Nettle and Kiefel has high projection on the first principle component and Justices Bell has high projection on the second principle component.

Who is the most animated judge

The PCA study can help us to answer the following question: Who is the most animated judge? Since PCs are linear combination of the original variables, Chao & Wu (2017) proposed to take the absolute value of the fitted PCs and add them up to create an index to measure [fill in here]. In this study, the first two PCs are added up to determine the most animated judge and find that [conclusion]

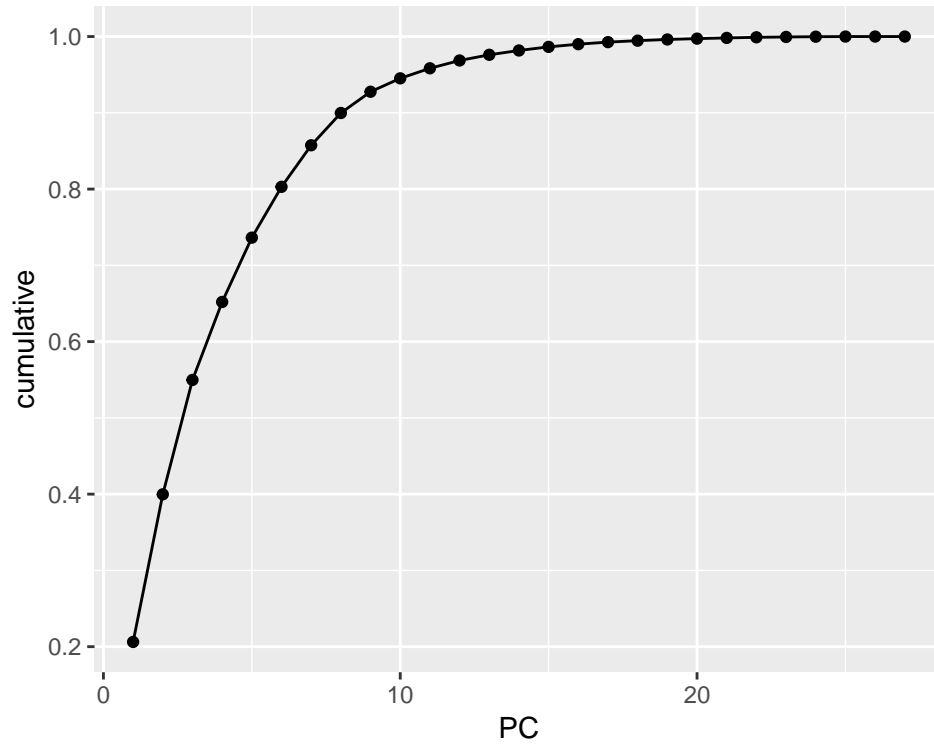


Figure 1: Scree plot for cummulative variance explained by the PCs.

Appendix

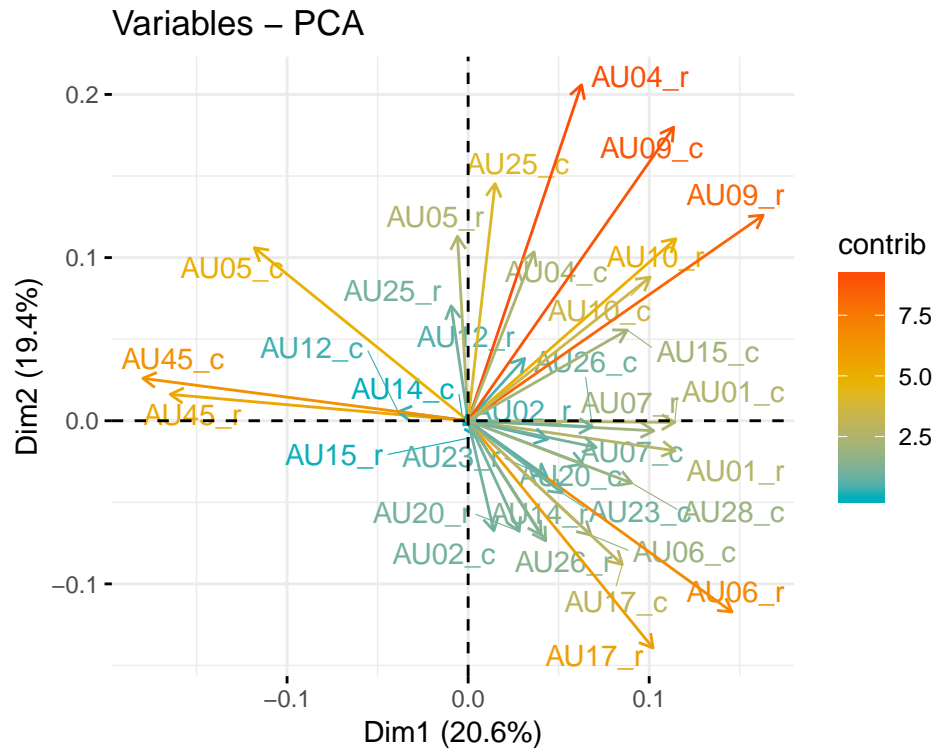


Figure 2: Visualisation of the variable importance in the first two PCs.

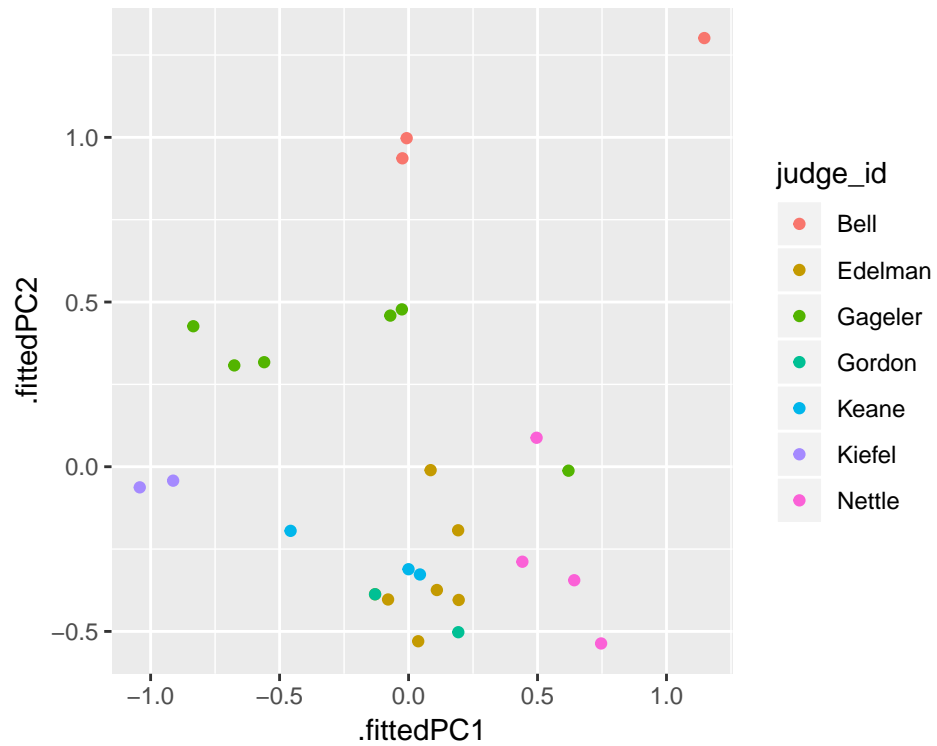


Figure 3: Visualisation of the first and second principle component.

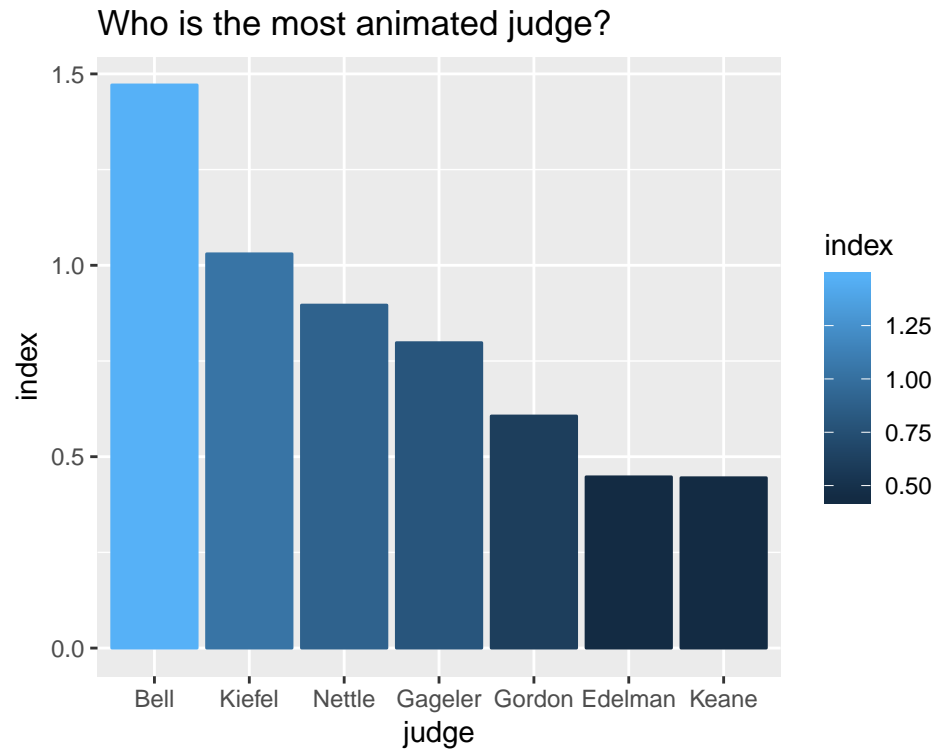


Figure 4: The most animated judge by adding up the first two principle components.

Reference

Chao, Y. S., & Wu, C. J. (2017). Principal component-based weighted indices and a framework to evaluate indices: Results from the medical expenditure panel survey 1996 to 2011. *PloS One*, 12(9), e0183997.