0.Thesis

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Data structure

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Action Unit across judge

Apart from understand how each judge behave consistently or not across all the video, we are also interested in comparing *across* all the judges to study who would appear more animated than others. In this piece of analysis we perform a principle component analysis (PCA) on the whole dataset with the time index being aggregated for each judge and video pair. Mathmetically, the data structure can be summarised as follows.

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

Result

The scree plot in Figure 3 shows that the cummulated variance explained by each prinicple component increase gradually, which suggests the data has a lot of noise. The variable plot in Figure 2 indicates some important variables that can be summarised into the following table.

PC#	Variables
PC1	AU06, AU09, AU17, AU45, AU05
PC2	AU04, AU05, AU06, AU09, AU17, AU25

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 [concluson]

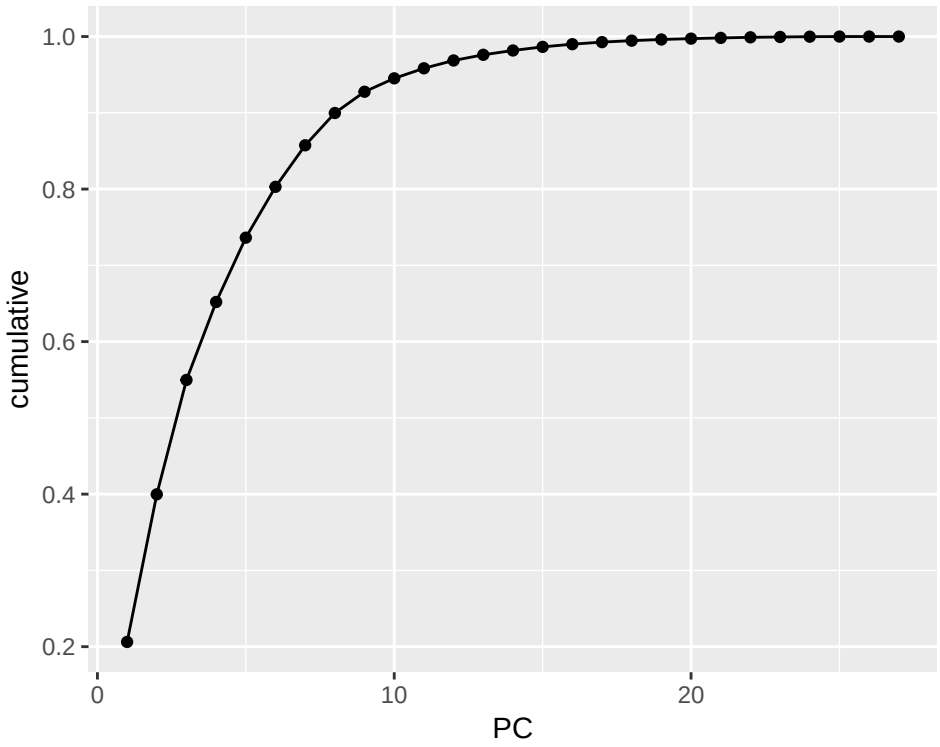

Figure 1: Scree plot for cummulative variance explained by the PCs.

Appendix

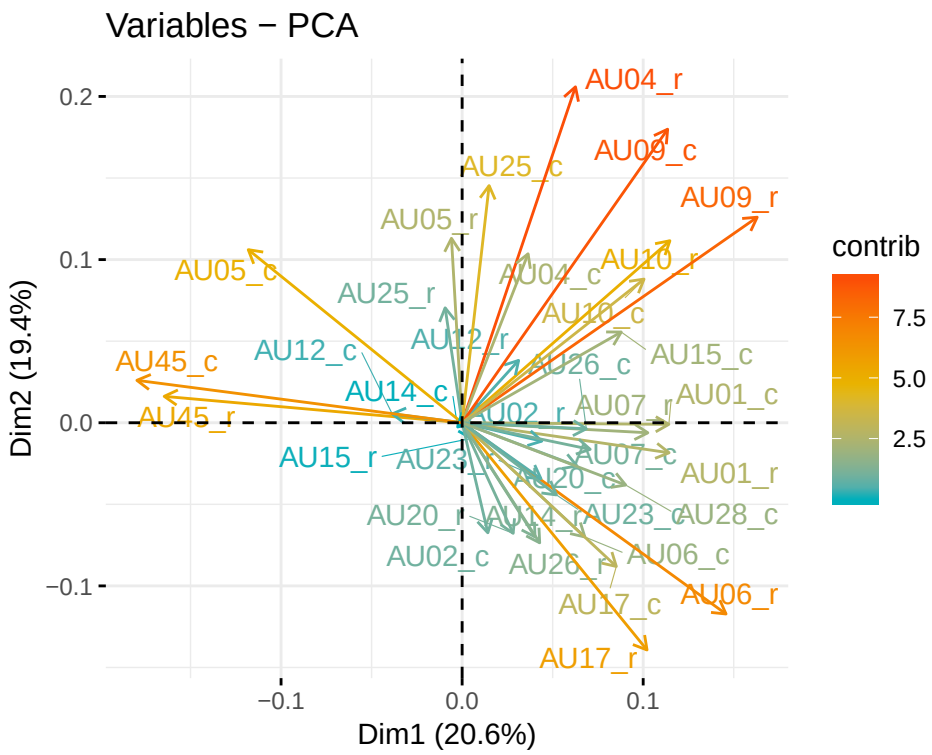

Figure 2: Visualisation of the variable importance in the first two PCs.

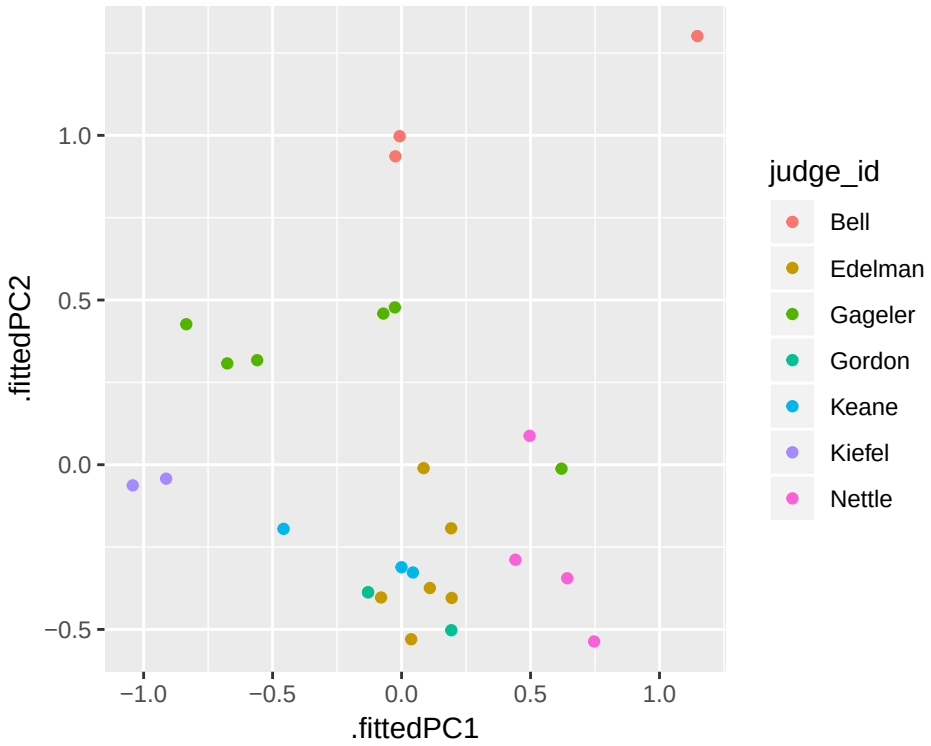

Figure 3: Visualisation of the first and second principle component.

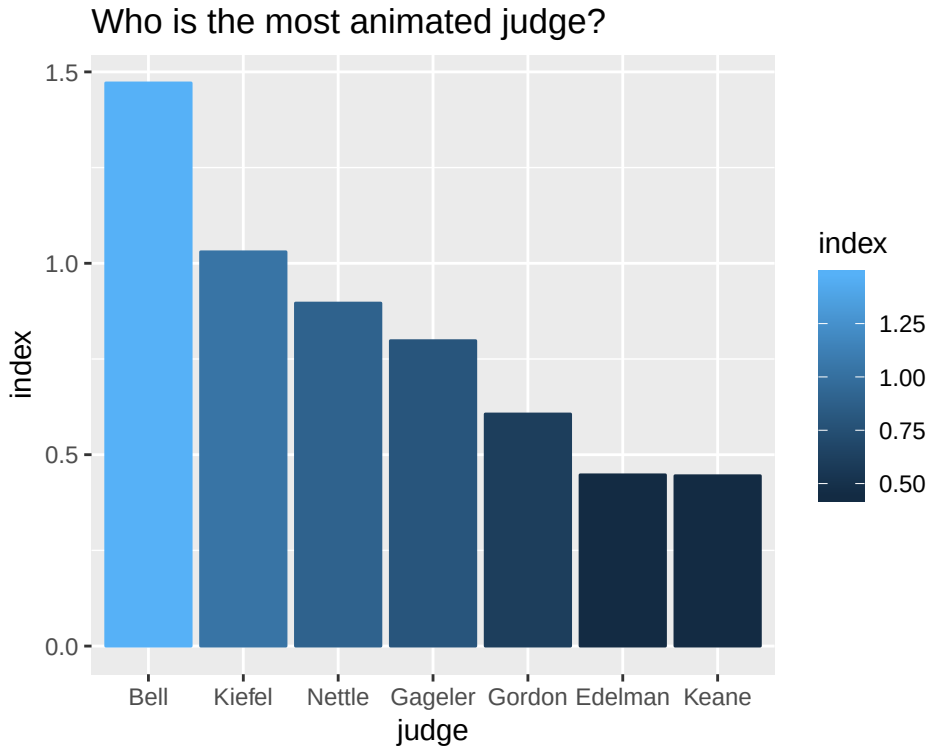

Figure 4: The most animated judge by adding up the first two principle components.

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.