

Problem n.1

The file `decathlon.txt` reports the results of the 23 best ranked athletes at Men's Decathlon during the 2016 Summer Olympics in Rio de Janeiro. Note that variables corresponding to time measurements (`100m`, `400m`, `110m_hurdles`, `1500m`) are expressed in seconds while variables corresponding to length measurements (`long_jump`, `shot_put`, `high_jump`, `discus_throw`, `pole_vault`, `javelin_throw`) are expressed in meters.

- a) Considering a Principal Component Analysis of the dataset, decide whether it is appropriate to use the original variables or the standardized ones. Propose in addition a simple transformation to have all variables denoting better performance for higher values. Perform the Principal Component Analysis and report the loadings of the first principal component.
- b) Report a plot of the loadings of the first 3 principal components and interpret them.
- c) Report the biplot of the data along the first two principal components and describe what characterizes the athletes with positive scores for both the first and second components. Proceed similarly with 2nd and 3rd principal components.
- d) Report the screeplot. Propose (with motivations) a dimensionality reduction of the dataset. Report the variance explained along the principal components retained.
- e) The Italian athlete Dario Dester established a new national record for Men's Decathlon on the occasion of the 2022 European Athletics Championships in Munich. His results per discipline for this performance are reported in Table 1.
Project these results on the reduced space identified at point (d). Interpret.

<i>100 metres</i>	10.81s
<i>Long jump</i>	7.46m
<i>Shot put</i>	14.56m
<i>High jump</i>	2.02m
<i>400 metres</i>	47.90s
<i>110 metres hurdles</i>	14.44s
<i>Discus throw</i>	43.04m
<i>Pole vault</i>	4.90m
<i>Javelin throw</i>	57.24m
<i>1500 metres</i>	4'41.63s

Table 1: Results per discipline of Dario Dester at the 2022 European Athletics Championships – Men's decathlon

Upload your results here:

<https://forms.office.com/Pages/ResponsePage.aspx?id=K3EXCvNtXUKAjjCd8ope6-9ASOGwf2lHjvGX24HiqFVUMk1PRThaSlU0T05PQU1PN0gxTjRfUjlYTy4u>