Comparing University Rankings: Statistical Analysis of Four Global University Ranking Systems

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Description of Data

- **US News Rankings from 2018**:
  1250 universities in overall ranking and 22 subject rankings
- **Shanghai Rankings (ARWU) from 2017**:
  500 universities in overall ranking and 52 subject rankings
- **QS Rankings from 2018**:
  959 universities in overall ranking and 48 subject rankings
- **Times Higher Education Rankings from 2018**:
  1103 universities in overall ranking; comparable subject rankings are not available

Measuring Distances between Rankings

- **Overlap (Aguillo, 2010)**:
  Normalized size of overlap between two top k lists
- **Kendall tau (Kendall, 1990)**:
  Proportion of pairs that are ranked differently
- **Spearman's rho**:
  Pearson correlation coefficient between ranked lists, normalized to a distance between 0 and 1
- **M measure (Aguillo, 2010)**:
  Weighted version of Spearman's rho
- **Ranking Discrepancy**:
  Mean highest/lowest rank ratio
  This measure can be applied to more than two rankings

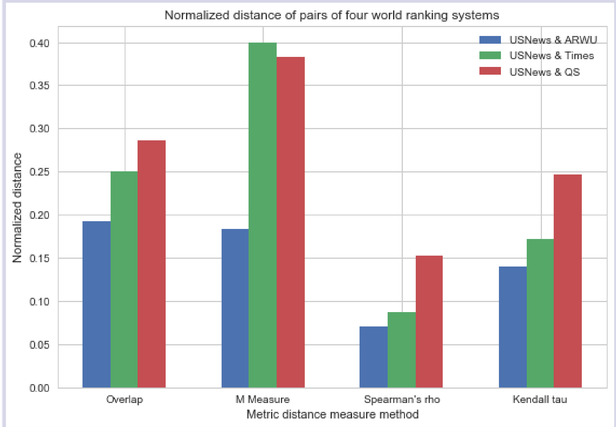
Example

University	A	B	C
Ranking I	1	2	3
Ranking II	3	1	2
Discrepancy	3/1	2/1	3/2

- **Kendall tau distance:**
  3 pairs (A, B), (A, C), (B, C)
  2 pairs (A, B), (A, C) ranked differently, $\Longrightarrow \boxed{\tau = 2/3}$
- **Spearman rho distance:**
  $\rho' =$ Corr. between (1, 2, 3) and (3, 1, 2) $= -1/2$
  $\Longrightarrow \boxed{\rho = (1/2)(1-\rho') = 3/4}$

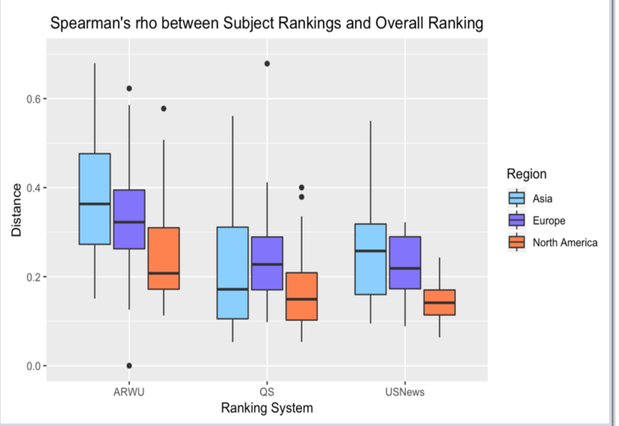
Similarities and Differences between Ranking Systems

US News versus Other Rankings



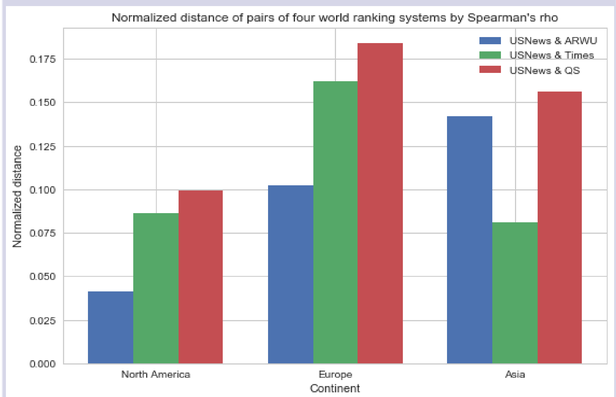
- The lowest distance is between US News and Shanghai Ranking (ARWU) in all four distance measures, which matches the results by Aguillo et al (Aguillo, 2010).
- The highest distance is between US News and QS in three out of four distance measures.

Overall versus Subject Rankings



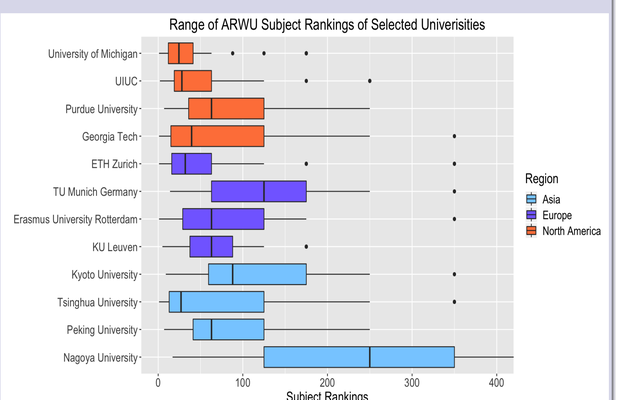
- By Spearman's rho distance, North America has the lowest average distance between overall rankings and subject rankings.
- p-values by paired comparison test: For Europe vs. North America, $p \leq 4 \times 10^{-6}$. For Asia vs. North America, $p \leq 0.004$.

Ranking Differences by Region



- The lowest distance between overall rankings over two out of three continents is between US News and Shanghai Ranking (ARWU).
- Among three regions, North America shows the lowest distance in pairwise distance comparison for two out of three pairs.

Homogeneity of Subject Rankings



- The above boxplots show the rankings of selected universities in 52 subjects.
- From the plot, North American universities seem to have the highest homogeneity in subject rankings, while Asian universities have the lowest homogeneity.

Summary of Results

- **Similarities and Differences between Ranking Systems**:
  - US News is most similar to Shanghai Ranking (ARWU) when measured by all four distance measures - Normalized size of overlap, Spearman's rho, Kendall tau and M measure.
  - US News is least similar to QS, when measured by the distance measures except for M measure.
- **Differences between Regions**:
  - The differences between rankings by US News and Shanghai Ranking (ARWU) are smallest in North America.
  - North America has the lowest average distance between overall rankings and subject rankings in all three ranking systems - US News, Shanghai Ranking (ARWU), and QS.

Future Research

- Extend the analysis to multiple years and analyze the year-to-year differences in rankings.
- Extend the analysis by considering other ranking systems such as HEEACT and CWUR.
- Explain our findings on differences between ranking systems in terms of the criteria used by the ranking systems.
- Investigate the ranking similarities and differences for selected subjects.

References

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