Appendix

Comparison between two dependent Spearman correlation coefficients

1. Background
   - A. Data
     - (a)Sample: 12 patients
     - (b)Design: 4 measurements per patient
       - Pre: Left hand, Right hand
       - Post: Left hand, Right hand
   - B. Null Hypothesis: Pre correlation between hands = Post correlation between hands
   - C. H_1: Two-tail
2. Procedure
   - A. Notation
     - (a) Let r_{ab} represent the Spearman correlation coefficients between variable *a* and variable *b*

       And let j correspond to Pre, Left hand
       k Pre, Right hand
       h Post, Left hand
       m Post, Right hand
     - (b) Then r_{jk} is the correlation between Pre-Left and Pre-Right hands
       r_{hm} between Post-Left and Post-Right hands
       r_{jh} between Pre-Left and Post-Left hands
       r_{jm} between Pre-Left and Post-Right hands
       r_{kh} between Pre-Right and Post-Left hands
       r_{km} between Pre-Right and Post-Right hands
   - B. Computation
     - (a) Compute all 6 r_{ab} coefficients
     - (b) Define
       $$c1 \equiv r_{jh}^2 + r_{jm}^2 + r_{kh}^2 + r_{km}^2$$
       $$c2 \equiv r_{jh} r_{km} + r_{jm} r_{kh}$$
       $$c3 \equiv r_{jk} r_{jh} r_{jm} + r_{jk} r_{kh} r_{km} + r_{jh} r_{kh} r_{hm} + r_{jm} r_{km} r_{hm}$$
       $$c4 \equiv (1 - r_{jk}^2)(1 - r_{hm}^2)$$
     - (c) Then
       $$c = (0.5 r_{jk} r_{hm} c1 + c2 - c3) / c4$$
   - C. Test
     - (a) standard deviation
       $$\sigma = \sqrt{\frac{2(1.06)(1-c)}{n-3}}$$
       where n = sample size
       Note: expression from Dunn (1969), p368, eq.9
       factor 1.06 from Zar (2010), §19.9, p400
     - (b) Fisher's transformation
       $$z_{jk} = \tanh^{-1}(r_{jk})$$
       $$z_{hm} = \tanh^{-1}(r_{hm})$$
       Note: applicable only for $r_{ab} \le 0.9$ and $n \ge 10$
     - (c) Finally $z = \frac{z_{jk} - z_{hm}}{\sigma}$ which is N (0,1) under H_0
   - D. Results
     - (a) *p*-value
       - If $p1$ is the upper tail
       - And $p2$ is the lower tail
       - Then $p = 2\min(p1, p2)$
     - (b)Features

       Analyse each of the 4 features separately