BioRID II R&R Test Series 2

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Shape Correlation

- Estimate of the similarity, in shape, between two (2) signals
- Shape (cross) correlation at shift “m”

$$S_{xy}(m) = \frac{\sum x_i \times y_{i+m}}{\sqrt{\sum x_i^2 \times \sum y_i^2}}$$

- Shape correlation

$$S = S_{xy}(m_o) = \max_m S_{xy}(m)$$

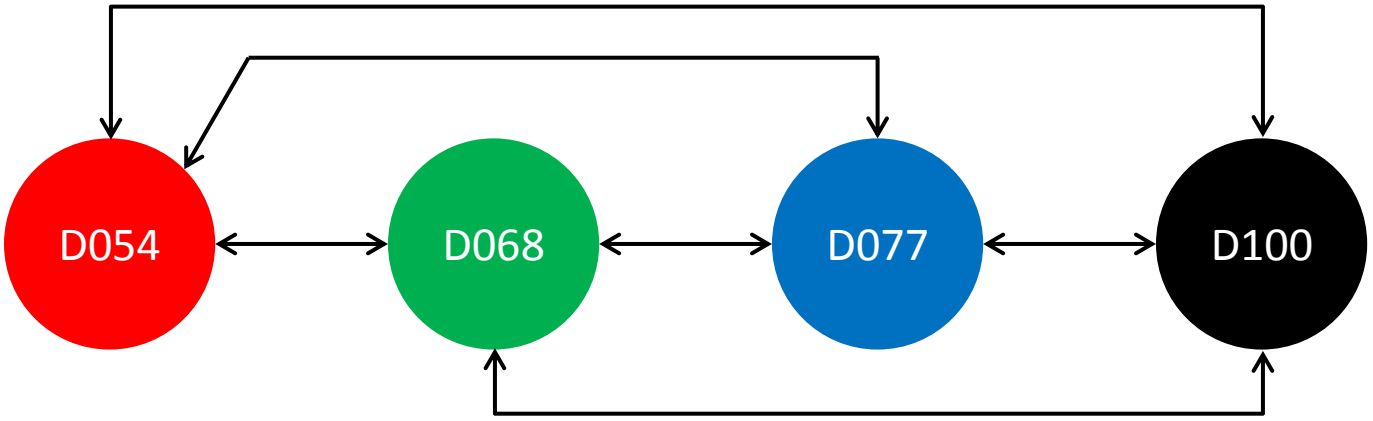
Shape Correlation – Repeatability

- Cross correlation of signals within the repeats of the same dummy
- We have five (6) repeats per dummy, thus ten (15) cross correlations for each dummy

		Test #						Number of Analysis
		1	2	3	4	5	6	
Test #	1		✓	✓	✓	✓	✓	5
	2			✓	✓	✓	✓	4
	3				✓	✓	✓	3
	4					✓	✓	2
	5						✓	1
	6							Total: (6x5)/2 = 15

Shape Correlation – Reproducibility

- Thirty six (36) cross correlations for each set of two (2) dummies
- We have four (4) dummies thus six (6) combinations for a total of two hundred sixteen (216) cross correlations



Magnitude

p−norm $$\|\mathrm{x}\|_p = \left(\sum |x_i|^p\right)^{\frac{1}{p}}$$

Taxicab $$\|\mathrm{x}\|_1 = \sum |x_i|$$

Euclidian $$\|\mathrm{x}\|_2 = \sqrt{\sum x_i^2}$$

Infinity $$\|\mathrm{x}\|_\infty = \max\{|x_1|, \ldots, |x_n|\}$$

Magnitude Coefficient of Variation

- For each of the magnitude measures, we compute the coefficient of variation

$$\mathrm{CV}_{\mathrm{Taxicab}} = {}^{\sigma_{\mathrm{Taxicab}}}\!/_{\mu_{\mathrm{Taxicab}}}$$

$$\mathrm{CV}_{\mathrm{Euclidian}} = {}^{\sigma_{\mathrm{Euclidian}}}\!/_{\mu_{\mathrm{Euclidian}}}$$

$$\mathrm{CV}_{\mathrm{Infinity}} = {}^{\sigma_{\mathrm{Infinity}}}\!\Big/_{\mu_{\mathrm{Infinity}}}$$

- The above values are computed for the twenty (24) signals distribution
- Note that $\mathrm{CV}_{\mathrm{Infinity}}$ is the commonly reported CV

Test Matrix

Test Order	Test #	Dummy	Date	Day	Week
1	M120917001	D068	9/17/2012	Monday	1
2	M120918001	D077	9/19/2012	Wednesday	
3	M120919001	D077	9/19/2012	Wednesday	
4	M120920001	D068	9/20/2012	Thursday	
5	M120920002	D054	9/20/2012	Thursday	
6	M120924001	D054	9/24/2012	Monday	2
7	M120924002	D100	9/24/2012	Monday	
8	M120924004	D100	9/24/2012	Monday	
9	M120925001	D100	9/25/2012	Tuesday	
10	M120925002	D054	9/25/2012	Tuesday	
11	M120925004	D068	9/25/2012	Tuesday	
12	M120926001	D077	9/26/2012	Wednesday	
13	M121010001	D054	10/10/2012	Wednesday	4
14	M121010002	D054	10/10/2012	Wednesday	
15	M121010003	D068	10/10/2012	Wednesday	
16	M121010004	D077	10/15/2012	Monday	5
17	M121015001	D100	10/15/2012	Monday	
18	M121015002	D054	10/15/2012	Monday	
19	M121017001	D068	10/17/2012	Wednesday	
20	M121017002	D100	10/17/2012	Wednesday	
21	M121017003	D077	10/17/2012	Wednesday	
22	M121017004	D077	10/17/2012	Wednesday	
23	M121018001	D100	10/18/2012	Thursday	
24	M121018002	D068	10/18/2012	Thursday	

Analyzed Channels

Test No.		5	6	10	13	14	18	1	4	11	15	19	24	2	3	12	16	21	22	7	8	9	17	20	23
		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1
		9	9	9	0	0	0	9	9	9	0	0	0	9	9	9	0	0	0	9	9	9	0	0	0
		2	2	2	1	1	1	1	2	2	1	1	1	1	1	2	1	1	1	2	2	2	1	1	1
		0	4	5	0	0	5	7	0	5	0	7	8	8	9	6	0	7	7	4	4	5	5	7	8
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		2	1	2	1	2	2	1	1	4	3	1	2	1	1	1	4	3	4	2	4	1	1	2	1
Dummy No.		D054	D054	D054	D054	D054	D054	D068	D068	D068	D068	D068	D068	D077	D077	D077	D077	D077	D077	D100	D100	D100	D100	D100	D100
Head	Ax	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	11	11	11	11	11	11
	Az	12	12	12	12	12	12	11	11	11	11	11	11	12	12	12	12	12	12	12	12	12	12	12	12
Neck	Fx	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	14	14	14	14	14	14
Upper	Fz	14	14	14	14	14	14	14	14	14	14	14	14	15	15	15	15	15	15	15	15	15	15	15	15
	My	15	15	15	15	15	15	15	15	15	15	15	15	17	17	17	17	17	17	16	16	16	16	16	16
	C4 Ax	17	17	17	17	17	17	17	17	17	17	17	17	20	20	20	20	20	20	18	18	18	18	18	18
	C4 Az	18	18	18	18	18	18	18	18	18	18	18	18	21	21	21	21	21	21	19	19	19	19	19	19
Lower	Fx	25	25	25	25	25	25	25	25	25	25	25	25	29	29	29	29	29	29	26	26	26	26	26	26
	Fz	26	26	26	26	26	26	26	26	26	26	26	26	30	30	30	30	30	30	27	27	27	27	27	27
	My	27	27	27	27	27	27	27	27	27	27	27	27	31	31	31	31	31	31	28	28	28	28	28	28
Thorax	T1 Ax	20	20	20	20	20	20	20	20	20	20	20	20	24	24	24	24	24	24	21	21	21	21	21	21
	T1 Az	21	21	21	21	21	21	21	21	21	21	21	21	25	25	25	25	25	25	22	22	22	22	22	22
	T8 Ax	23	23	23	23	23	23	23	23	23	23	23	23	27	27	27	27	27	27	24	24	24	24	24	24
	T8 Az	24	24	24	24	24	24	24	24	24	24	24	24	28	28	28	28	28	28	25	25	25	25	25	25
Lumbar	L1 Ax	29	29	29	29	29	29	28	28	28	28	28	28	32	32	32	32	32	32	35	35	35	35	35	35
	L1 Az	28	28	28	28	28	28	29	29	29	29	29	29	33	33	33	33	33	33	36	36	36	36	36	36
Pelvis	Ax	31	31	31	31	31	31	31	31	31	31	31	31	36	36	36	36	36	36	38	38	38	38	38	38
	Az	33	33	33	33	33	33	33	33	33	33	33	33	35	35	35	35	35	35	40	40	40	40	40	40
Total Number of Chann		18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Noisy Channel																									
Defective Channel																									

Analysis Results

Show result plots

Results Summary

			Shape												Magnitude CVs - Reproducibility												
			Repeatabilty					Reproducibility							Taxicab					Euclidian					Infinity				
								D054	D054	D054	D066	D066	D077																
			D054	D066	D077	D100	All	D066	D077	D100	D077	D100	D100	All	D054	D066	D077	D100	All	D054	D066	D077	D100	All	D054	D066	D077	D100	All
Head		Ax	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	2.75
		Az	3	3	3	3	3	2	3	3	2	2	3	2.5	3	2	3	2	2.5	3	2	2	2	2.25	3	1	2	1	1.75
Neck	Upper	Fx	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	2	2.5	3	2	3	3	2.75	3	3	3	3	3
		Fz	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2.5	2	2	3	3	2.5	3	2	3	3	2.75
		My	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	2	1	1	3	3	2	3	1	3	1	2
		C4 Ax	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2.5	3	3	3	3	3	3	2	1	2	2
		C4 Az	3	3	3	3	3	2	2	3	2	2	3	2.333	3	1	1	3	2	3	1	1	3	2	1	1	0	3	1.25
	Lower	Fz	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	3	1.5	0	3	0	3	1.5	2	0	0	3	1.25
		My	2	2	3	2	2.25	1	2	2	2	2	3	2	2	2	1	3	2	2	3	1	3	2.25	2	3	1	2	2
Thorax		T1 Ax	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	2.5	3	2	3	3	2.75	3	2	3	2	2.5
		T1 Az	2	2	2	3	2.25	1	1	1	1	1	2	1.167	3	2	1	3	2.25	3	2	2	3	2.5	1	1	1	1	1
		T8 Ax	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		T8 Az	2	1	2	2	1.75	1	1	1	0	1	1	0.833	2	1	3	1	1.75	2	2	3	1	2	1	3	3	2	2.25
Lumbar		L1 Ax	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	2	1.75
		L1 Az	3	3	3	3	3	2	2	3	2	2	2	2.167	3	3	2	3	2.75	3	3	2	3	2.75	3	0	1	1	1.25
Pelvis		Ax	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	2.75	3	2	3	2	2.5	2	1	2	0	1.25
		Az	3	1	2	3	2.25	1	2	2	1	1	2	1.5	2	0	1	3	1.5	2	0	1	3	1.5	1	0	2	1	1
Counts	Good	>= 97.5 %	76%	71%	76%	82%	76%	53%	59%	71%	53%	53%	71%	41%	59%	24%	59%	82%	56%	65%	41%	59%	82%	62%	53%	24%	47%	35%	40%
	Acceptabl	>= 95.0 %	24%	18%	24%	18%	21%	18%	24%	12%	24%	24%	18%	13%	29%	47%	12%	12%	25%	24%	41%	18%	12%	24%	18%	24%	18%	29%	22%
	Marginal	>= 90.0 %	0%	12%	0%	0%	3%	29%	18%	18%	18%	24%	12%	12%	12%	24%	29%	6%	18%	6%	12%	18%	6%	10%	29%	35%	24%	29%	29%
	Poor	< 90.0 %	0%	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%	1%	0%	6%	0%	0%	1%	6%	6%	6%	0%	4%	0%	18%	12%	6%	9%

		Individual Dummy	Averaged Results
Good	>= 97.5 %	3	2.5 =< v =< 3.0
Acceptabl	>= 95.0 %	2	1.5 =< v < 2.5
Marginal	>= 90.0 %	1	0.5 =< v < 1.5
Poor	< 90.0 %	0	0.0 =< v < 0.5