Evaluation of the panel and panelists performances in R

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introduction

- in the sensory world, most companies spend a lot of money in training their expert panel
- after each test, they need quick answers about the quality of their panel, and of the panelists individually
- if some of the panelists show inconsistencies, complementary training session, to readjust them, has to be done

paradox

- panel and panelists performances is in the centre of attention of (almost) all sensory departments
  - a lot of companies have at least one expert panel
  - a lot of papers are published on this topic
- nevertheless, a quick look to the market shows a lack of software, which measures the complete performance of the panel and panelists
- emergence of free software, which permits to share easily programs and methods

  (i.e. R and its packages)

our idea

- to develop a program, which measures the panel and panelists performances

- it should:
  - be as complete as possible
  - be as easy to use as possible
  - be as easy to interpret as possible
  - give quick answers to the panel leaders/statisticians

our program

- easiest interface for programming/sharing this program, for us:

  R (R development Core Team, 2008)

- it is based on the paper:
  - Assessing the Performance of a Sensory Panel – Panelist monitoring and tracking (Kermit M. & Lengard V., 2005)

illustration with an example

- the dataset “sensochoc” is taken from the package SensoMineR (Husson & Lê, 2007)
  - 6 chocolates
  - 29 panelists
  - 2 sessions
  - 14 descriptors

panel performance

- the panel performance is based on a three-way Anova with interactions, regarding to the following model:

  for each attribute

  - Attribute = μ + product + judge + session
    + product:judge + product:session
    + judge:session + ε

- the judge effect can be set as *fixed* or *random*

panel performance

- important effects
  - product → discrimination
  - product:judge → agreement
  - product:session → reproducibility

- less important effects
  - judge → different use of the scale for the panelists
  - session → different use of the scale in the different sessions
  - judge:session → different use of the scale of the panelists from one session to the other

panel performance

Panel Performance (Att=u+p+J+s+pJ+ps+Js+e)

	Product	Panelist	Session	Product:Panelist	Product:Session	Panelist:Session
CocoaA	0	0	0.24	0.99	0.8	0.83
MilkA	0	0	0.29	0.093	0.83	0.23
CocoaF	0	0	0.097	0.007	0.45	0.094
MilkF	0	0	0.092	0.007	0.12	0.015
Caramel	0	0	0.95	0.003	0.073	0.001
Vanilla	0	0	0.23	0.003	0.32	0.038
Sweetness	0	0	0.062	0.12	0.12	0.003
Acidity	0	0	0.53	0.001	0.98	0.008
Bitterness	0	0	0.012	0.026	0.19	0.055
Astringency	0	0	0.94	0.059	0.082	0.059
Crunchy	0	0	0.055	0.024	0.69	0.004
Melting	0	0	0.12	0	0.3	0.062
Sticky	0.001	0	0.47	0.054	0.01	0.048
Granular	0	0	0.15	0.015	0.28	0.31

panel performance: summary

Panel summary (Percentage)

	Panel	
Discrimination	100	14 out of 14 attributes
Reproducibility	92.9	13 out of 14 attributes
Agreement	35.7	5 out of 14 attributes
Scale(Session)	92.9	13 out of 14 attributes

panelist performance

- the performance is measured through 6 criteria
  - discrimination
  - reproducibility
  - agreement
    - crossover (if there is a disagreement)
  - correlations
  - use of the scale (for the different sessions)

panelist performance: discrimination

- the panelist performance is measured regarding to one-way Anovas done for each panelist

  for the attribute j of a panelist i

  - $Att_{i,j} = \mu + product + \varepsilon$

- the product effect measures the discrimination ability of the panelist i on the attribute j

Panelist Discrimination

panelists

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
CocoaA	0.19	0.83	0.011	0.15	0.11	0.91	0.88	0.33	0.021	0.74	0.42	0.36	0.023	0.52	0.075	0.59	0.46	0.51	0.35	0.55	0.73	0.79	0.99	0.064	0.69	0.47	0.41	0.029	1
MilkA	0.41	0.99	0.062	0.083	0.71	0.64	0.85	0.18	0.007	0.35	0.11	0.17	0.025	0.24	0.85	0.27	0.5	0.23	0.35	0.81	0.001	0.062	0.93	0.022	0.96	0.77	0.34	0.001	0.17
CocoaF	0.008	0.26	0.033	0.78	0.052	0.095	0.65	0.034	0.003	0.17	0.27	0.24	0.003	0.031	0	0.011	0.048	0.089	0.27	0.05	0.84	0.1	0.003	0.006	0.3	0.13	0.14	0.005	0.13
MilkF	0.021	0.47	0.014	0.034	0.11	0.54	0.58	0.002	0.033	0	0.012	0.018	0.001	0.061	0.043	0.17	0.008	0	0.011	0.005	0.003	0.018	0.004	0.065	0.43	0.27	0.12	0.001	0.17
Carame	0.18	0.58	0.2	0.14	0.033	0.45	0.45	0.64	0.011	0.11	0.003	0.22	0.41	0.33	0.008	0.001	0.002	0.21	0.13	0.15	0.001	0.001	0.042	0.011	0.94	0.003	0.8	0.008	0.14
Vanilla	0.066	0.57	0.45	0.15	0.14	0.67	0.73	0.48	0.38	0.1	0.028	0.017	0.017	0.92	0.097	0.2	0.005	0.41	0.19	0.66	NaN	NaN	0.082	0.025	0.49	0.29	0.7	0.41	0.087
Sweetness	0.38	0.48	0.007	0.41	0.002	0.43	0.16	0.18	0.007	0.11	0.06	0.046	0.46	0.19	0.22	0.067	0.01	0.03	0.16	0.19	0.2	0.49	0.12	0.025	0.79	0.26	0.89	0	0.13
Acidity	0.32	0.49	0.088	0.1	0.3	0.16	0.039	0.52	0.056	0.59	0.12	0.45	0.62	0.49	0.36	0.041	0.14	0.047	0.49	0.33	0.001	0.028	0.016	0.095	0.43	0.036	0.43	0.84	0.41
Bitterness	0.063	0.53	0.048	0.24	0.072	0.58	0.8	0.14	0.057	0.089	0.26	0.005	0.79	0.1	0.006	0.001	0.087	0.004	0.14	0.035	0.29	0.003	0.045	0.1	0.007	0.24	0.23	0.007	0.02
Astringency	0.13	NaN	0.028	0.094	0.2	0.079	0.29	0.44	0.2	0.15	0.93	0.59	0.26	0.13	0.12	0.002	0.51	0.25	0.92	0.16	0.041	0.57	0.41	0.26	0.15	0.54	0.33	0.032	0.53
Crunchy	0.37	0.004	0.079	0.82	0.65	0.017	0.026	0.035	0.066	0.01	0.11	0.19	0.46	0.058	0.39	0.036	0.008	0.59	0.012	0.05	0.59	0.002	0.079	0.067	0.003	0.022	0.1	0.13	0.26
Melting	0.044	0.12	0.75	0.001	0.78	0.71	0.046	0.14	0.23	0.73	0.012	0.67	0.027	0.12	0.2	0	0.005	0.39	0.16	0.35	0.038	0.12	0.47	0.39	0.46	0.6	0.34	0.09	0.031
Sticky	0.38	0.65	0.65	0.06	0.42	0.66	0.24	0.086	0.28	0.5	0.13	0.35	0.38	0.22	0.19	0.28	0.37	0.093	0.63	0.46	0.76	0.41	0.9	0.084	0.88	0.7	0.83	0.031	0.57
Granular	0.88	0.31	0.57	0.56	0.11	0.028	0.22	0.019	0.32	0.005	0.15	0.69	0.85	0.044	0.8	0.7	0.069	0.055	0.62	0.072	0.34	0.75	0.013	0.71	0.83	0.05	0.19	0.77	0.2

panelist performance: reproducibility

1. a "full" two-way Anova is run for each attribute
   - Att = μ + product + judge + product:judge + $\varepsilon^{(full)}$
2. the residual "full" $\varepsilon^{(full)}$ is standardized
   - divided by $\sqrt{MS_{error}^{(full)}}$
3. the contribution of the panelists to this error is measured with a one-way Anova run for each assessor:
   - $\varepsilon^{(full)}$ = μ + product + $\varepsilon^{(repro)}$
4. the sum of squares of the "repro" error is submitted to a χ^2 test with (P(S-1)) degrees of freedom
   - SS(repro) ~ $\chi^2_{P(S-1)}$

Panelist Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
CocoaA	0.93	0.77	0.96	0.72	0.84	0.18	0.004	0.089	0.82	0.89	0.52	0.62	0.84	0.98	0.93	0.48	0.45	0.07	0.76	0.003	0.8	0.5	0.58	0.97	0.84	0.8	0.91	0.82	0
MilkA	0.95	0.01	0.85	0.43	0.27	0.26	0.043	0.23	0.84	0.75	0.99	0.75	0.7	0.99	0.47	0.38	0.45	0.57	0.28	0.001	1	0.52	0.57	0.96	0.38	0.14	0.63	0.98	0.2
CocoaF	0.89	0.31	0.89	0.33	0.69	0.93	0.003	0.21	0.81	0.45	0.21	0.5	0.89	0.97	0.95	0.84	0.69	0.45	0.093	0.013	0.057	0.69	0.78	0.98	0.56	0.19	0.91	0.93	0.012
MilkF	0.92	0.048	0.61	0.14	0.9	0.054	0.021	0.76	0.2	1	0.86	0.66	0.94	0.63	0.27	0.12	0.53	0.98	0.48	0.43	0.98	0.51	0.82	0.39	0.26	0.44	0.44	0.92	0.005
Caramel	0.64	0.4	0.96	0.24	0.84	0.52	0.034	0.001	0.93	0.58	0.99	0.089	0.89	0.8	0.62	0.95	0.98	0.21	0.6	0.23	1	0.97	0.84	0.93	0.006	0.95	0.05	0.66	0.03
Vanilla	0.9	0.98	0.32	0.12	0.32	0.2	0.012	0.01	0.34	0.52	0.69	0.49	0.99	0.97	0.72	0.092	0.96	0.2	0.78	0.068	1	1	0.75	0.96	0.25	0.9	0.44	0.54	0.013
Sweetness	0.82	0.074	0.87	0.003	0.98	0.92	0.57	0.57	0.98	0.59	0.65	0.96	0.06	0.82	0.048	0.95	0.76	0.76	0.69	0.009	0.46	0.67	0.95	0.93	0.35	0.07	0.043	1	0.078
Acidity	0.38	0.86	0.3	0.11	0.91	0.88	0.8	0.007	0.59	1	1	0.24	0.055	0.86	0.52	0.42	0.12	0.25	0.86	0.005	1	0.76	0.86	0.36	1	0.94	0.39	0.26	0.03
Bitterness	0.65	0.12	0.61	0.47	0.73	0.26	0	0.12	0.47	0.49	0.36	0.83	0.026	0.86	0.73	0.95	0.51	0.94	0.17	0.24	0.75	0.83	0.65	0.73	0.98	0.095	0.79	0.88	0.57
Astringency	0.92	1	0.95	0.092	0.46	0.43	0.002	0.053	0.62	0.65	0.068	1	0.65	1	0.6	0.94	0.1	0.069	0.5	0.075	0.75	0.99	0.89	0.56	0.48	0.4	0.71	0.67	0.04
Crunchy	0.45	0.98	0.64	0.047	0.57	0.99	0.66	0.61	0.25	1	0.77	0.28	0.12	0.79	0.004	0.4	0.81	0.009	0.9	0.13	0.35	0.86	0.24	0.83	0.93	0.94	0.99	0.35	0.026
Melting	0.69	0.5	0.067	0.93	0.17	0.1	0.52	0.021	0.54	0.77	0.93	0.078	0.81	0.95	0.3	0.98	0.72	0.041	0.69	0.036	0.78	0.1	0.54	0.63	0.98	0.46	0.9	0.37	0.59
Sticky	0.56	0.27	0.87	0.72	0.43	0.004	0.5	0.56	0.55	0.21	0.67	0.23	0.85	0.82	0.99	0.47	0.47	0.57	0.67	0.072	0.58	0.87	0.31	0.57	0.007	0.29	0.69	0.89	0.32
Granular	0.27	0.43	0.49	0.009	0.72	0.92	0.046	0.49	0.17	0.96	0.96	0.81	0.11	0.96	0.46	0.078	0.49	1	0.96	0.086	0.13	0	0.99	0.39	1	0.98	0.99	0.32	0.96

panelist performance: agreement

1. a reduced two-way Anova without interaction is done
   - $Att = \mu + product + judge + \varepsilon^{(red)}$
2. the difference between the unstandardized full error and the unstandardized reduced error is computed
   - $\Phi^{(agree)} = \varepsilon^{(full)} - \varepsilon^{(red)}$
3. it is submitted to one-way Anova for each panelist
   - $\Phi^{(agree)} = \mu + product + \varepsilon^{(agree)}$
4. a F-test for the significance of the contribution to the disagreement is computed
   - $F = MS_{(red)}^{(agree)} \Big/ MS_{error}^{(full)}$

Panelist Agreement

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
CocoaA	0.91	0.98	0.44	0.78	0.26	0.74	0.22	0.33	0.1	0.98	0.2	0.88	0.3	0.91	0.87	0.86	0.87	0.65	0.89	0.15	0.96	0.94	0.72	0.99	0.8	0.54	0.92	0.37	0.91
MilkA	0.82	0.84	0.37	0.18	0.4	0.4	0.15	0.09	0.018	0.92	0.32	0.79	0.1	0.89	0.81	0.67	0.89	0.35	0.57	0.21	0.36	0.063	0.66	0.65	0.52	0.24	0.55	0.13	0.001
CocoaF	0.56	0.96	0.99	0.18	0.65	0.2	0.007	0.1	0.057	0.54	0.093	0.94	0.51	0.89	0.002	0.052	0.85	0.59	0.77	0.002	0.02	0.43	0.14	0.95	0.49	0.54	0.88	0.61	0.025
MilkF	0.78	0.79	0.71	0.27	0.098	0.11	0.05	0.23	0.1	0.89	0.83	0.71	0.69	0.97	0.33	0.39	0.36	0.84	0.34	0.069	0.53	0.012	0.49	0.84	0.51	0.11	0.001	0.4	0.083
Caramel	0.97	0.89	0.5	0.03	0.42	0.89	0.004	0.26	0.77	0.49	0.98	0.18	0.86	0.85	0.048	0.009	0.88	0.89	0.094	0.6	0.97	0.36	0.95	0.84	0.068	0.037	0.41	0.042	0.006
Vanilla	0.9	0.92	0.87	0.057	0.065	0.078	0.015	0.029	0.85	0.053	0.067	0.002	0.99	0.8	0.81	0.13	0.32	0.57	0.091	0.59	0.67	0.67	0.7	0.87	0.053	0.85	0.38	0.95	0
Sweetness	0.97	0.94	0.23	0.023	0.49	0.055	0.17	0.58	0.75	0.52	0.81	0.56	0.7	0.91	0.38	0.61	0.26	0.2	0.91	0.056	0.91	0.45	0.7	0.87	0.81	0.52	0.093	0.98	0.16
Acidity	0.59	0.85	0.21	0.015	0.089	0.6	0.3	0.17	0.38	0.56	0.65	0.34	0.88	0.14	0.082	0.001	0.073	0.014	0.94	0.012	0.58	0.11	0.22	0.3	0.47	0.058	0.24	0.84	0.28
Bitterness	0.84	0.9	0.5	0.75	0.61	0.33	0.14	0.27	0.39	0.14	0.86	0.29	0.73	0.94	0.025	0.008	0.69	0.058	0.78	0.058	0.42	0.02	0.79	0.88	0.88	0.7	0.17	0.73	0.04
Astringency	0.33	0.52	0.93	0.034	0.34	0.15	0.016	0.13	0.9	0.74	0.65	0.49	0.073	0.78	0.57	0.08	0.53	0.071	0.18	0.067	0.4	0.79	0.97	0.93	0.69	0.34	0.97	0.19	0.33
Crunchy	0.9	0.15	0.28	0.79	0.2	0.023	0.57	0.66	0.37	0.9	0.41	0.98	0.46	0.23	0.51	0.21	0.11	0.56	0.91	0.012	0.8	0.032	0.3	0.44	0.44	0.99	0.55	0.13	0.14
Melting	0.37	0.6	0.67	0.001	0.44	0.067	0.051	0.001	0.83	0.87	0.6	0.74	0.047	0.82	0.35	0.001	0.003	0.028	0.42	0.062	0.16	0.09	0.85	0.83	0.18	1	0.095	0.29	0.005
Sticky	0.57	0.35	1	0.021	0.43	0.068	0.03	0.14	0.29	0.59	0.2	0.35	0.67	0.19	1	0.15	0.38	0.086	0.86	0.19	0.82	0.97	0.98	0.14	0.29	0.84	0.98	0.29	0.35
Granular	0.51	0.17	0.74	0.096	0.33	0.077	0.03	0	0.13	0.051	0.79	0.92	0.77	0.4	0.28	0.32	0.012	0.95	0.86	0	0.28	0.27	0.47	0.71	0.86	0.79	0.81	0.98	0.81

panelist performance: cross-over

- when a disagreement is observed, it is important to check if it is due to a "cross-over" effect, or to a different "use of the scale" effect
  - the "cross-over" effect occurs when a panelist scores products opposite in intensity to the rest of the panel

- it is measured by partitioning the agreement error
  - the difference t_j between the panel mean and the product mean is calculated
  - the sign of t_j is compared to the sign of $\Phi^{(agree)}$
  - the $SS_{cross\text{-}over}$ error is compared to the $SS_{agreement}$ error
  - the portion of agreement error related to cross-over is calculated (expressed in percentage)

Crossover (Percentage)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
CocoaA																													
MilkA								86	76													57							17
CocoaF							28		42		28				80	26				99	9								74
MilkF					0		22													99		33					12		47
Caramel				40			22								99	26			15						23	58		86	60
Vanilla				95	14	19	34	83		50	51	55							5						1				96
Sweetness				31		3														100							2		
Acidity				78	4										23	67	64	100		78						1			
Bitterness															64	66		23		100		57							45
Astringency				86			76						0			71		64		96									
Crunchy						4														52		66							
Melting				52		6	56	54					35			60	68	21		50		90					0		50
Sticky				33		27	22											35											
Granular				43		33	93	70		61							35			75									

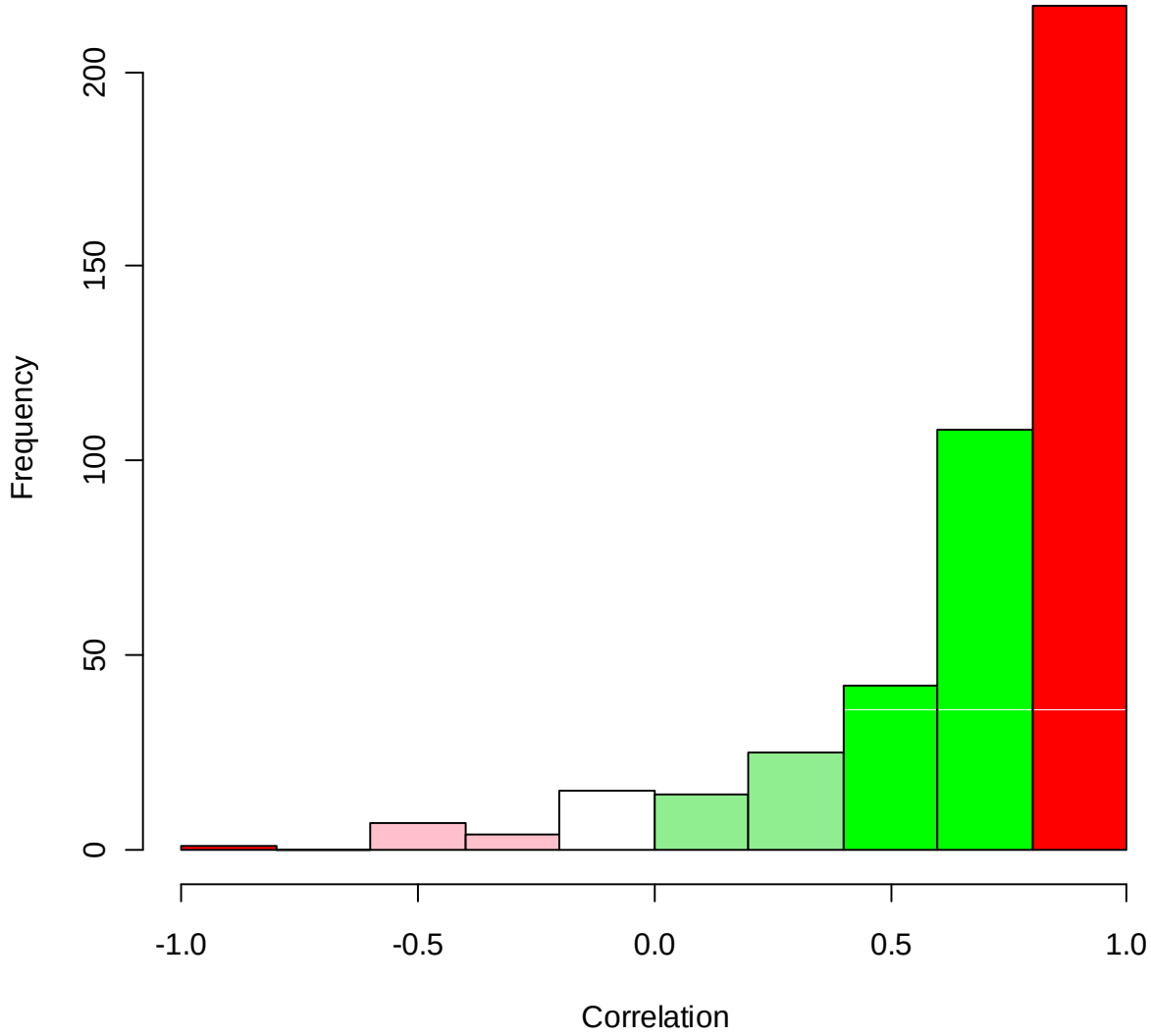
panelist performance: correlations

- the correlations between a judge and the rest of the panels are calculated for each attribute
- the mean by judge over all attributes is computed
- the distribution of the correlation coefficients can be represented
- the correlations (and their representation) can also be calculated by session

Correlation (Overall)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
CocoaA	1	0.99	0.88	0.92	0.76	0.38	0.75	0.94	0.78	0.82	-0.06	0.8	0.9	0.53	0.82	0.68	0.8	0.89	0.72	0.68	0.74	0.69	-0.13	0.95	0.34	0.12	0.66	0.94	0.53
MilkA	0.8	0.89	0.89	0.95	0.09	0.46	0.41	0.76	0.51	0.79	-0.37	0.84	0.94	0.51	0.38	0.92	0.79	0.45	0.77	0.32	0.47	0.67	-0.14	0.8	-0.47	-0.18	0.44	0.98	-0.33
CocoaF	1	1	0.99	0.97	0.91	0.86	0.88	0.96	0.94	0.81	0.56	0.95	0.96	0.95	0.89	0.63	0.93	0.86	0.91	0.97	0.1	0.76	0.95	0.94	0.78	0.89	0.99	0.89	0.83
MilkF	1	1	0.98	0.97	0.93	0.91	0.84	0.98	0.97	0.95	0.94	0.93	0.99	0.98	0.9	0.85	0.98	0.98	0.96	0.98	0.87	0.69	0.94	0.94	0.92	0.7	0.33	0.95	0.85
Caramel	0.98	0.99	0.93	0.91	0.96	0.79	0.76	0.94	0.96	0.76	0.98	0.74	0.96	0.87	0.95	0.72	0.95	0.96	0.44	0.9	0.95	0.91	0.95	0.93	0.02	0.57	0.59	0.9	0.65
Vanilla	0.9	0.94	0.91	0.95	0.72	0.58	0.82	0.9	0.98	0.35	0.69	0.71	0.92	0.59	0.95	0.82	0.84	0.72	-0.12	0.63			0.89	0.9	-0.21	0.66	0.1	0.87	0.85
Sweetness	0.96	0.96	0.99	0.84	0.98	0.9	0.93	0.82	0.97	0.78	0.95	0.66	0.84	0.87	0.93	0.68	0.96	0.7	0.89	0.92	0.92	0.53	0.72	0.89	0.83	0.9	0.02	0.95	0.91
Acidity	0.92	0.88	0.97	0.82	-0.42	0.54	0.8	0.84	0.9	-0.05	0.37	0.47	0.89	-0.48	-0.09	0.25	0.8	0.86	0.81	0.55	0.64	0.66	0.79	0.94	-0.19	-0.02	0.27	0.66	0.76
Bitterness	0.98	0.97	0.98	0.97	0.94	0.84	0.78	0.9	0.97	0.65	0.9	0.92	0.86	0.94	0.77	0.66	0.88	0.63	0.96	0.89	0.71	0.77	0.93	0.91	0.91	0.91	0.5	0.96	0.73
Astringency	0.96	0.96	0.89	0.93	0.93	0.89	0.82	0.81	0.91	0.82	0.49	0	-0.04	0.66	0.81	0.8	0.68	0.61	-0.53	0.83	0.82	0.79	0.91	0.9	0.88	0.33	0.9	0.83	0.61
Crunchy	0.91	0.95	0.96	0.95	0.95	0.94	0.98	0.87	0.94	0.92	0.69	0.98	0.73	0.63	0.91	0.9	0.8	0.8	0.96	0.81	0.87	0.82	0.89	0.72	0.92	0.97	0.81	0.64	0.77
Melting	0.93	0.92	0.79	0.74	0.84	0.73	0.7	0.95	0.72	0.8	0.87	0.74	0.42	0.73	0.73	0.23	0.8	0.29	0.58	0.5	0.59	0.9	0.77	0.75	-0.54	0.97	-0.36	0.88	0.37
Sticky	0.81	0.78	0.76	0.34	0.39	0.3	-0.17	0.81	0.15	0.78	0.36	0.75	0.1	-0.51	0.82	-0.05	0.28	0.49	0.43	0.54	0.21	0.82	0.74	0.81	-0.17	0.65	0.68	0.82	-0.03
Granular	0.81	0.91	0.66	0.34	0.13	0.56	0.71	0.69	0.56	0.36	0.46	0.47	0.44	0.29	-0.82	0.13	0.2	0.41	0.14	0.53	0.79	0.71	0.18	0.32	-0.4	0.65	0.09	0.86	0.39
MEAN	0.93	0.94	0.9	0.83	0.65	0.69	0.71	0.87	0.8	0.68	0.56	0.71	0.71	0.54	0.64	0.59	0.76	0.69	0.57	0.72	0.67	0.75	0.67	0.83	0.26	0.58	0.43	0.87	0.56

Distribution of the correlations (overall)



panelist performance: use of the scale

- for each panelist, a two-way Anova is run

  for each attribute

  - Att = μ + product + session + ε

- the session effect shows for each attribute and each panelist the use of the scale (scale effect) from one session to another

Scale Effect

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
CocoaA	0.076	0.44	0.58	0.1	0.39	0.48	0.58	0.53	0.11	0.82	0.76	0.4	0.39	0.042	0.29	0.36	0.78	0.77	0.44	0.43	0.7	0.88	0.88	0.53	0.68	0.2	0.64	0.54	0.27
MilkA	0.61	0.00057	0.11	0.89	0.91	0.21	0.65	0.56	0.2	0.6	0.74	0.86	0.74	0.74	0.18	0.11	0.59	0.88	0.1	0.54	0.61	1	0.88	0.41	0.7	0.46	0.33	0.36	0.58
CocoaF	0.24	0.11	1	0.75	0.52	1	0.18	0.093	0.46	0.06	0.77	0.86	0.24	1	0.042	0.61	0.26	0.06	0.21	0.84	0.25	0.52	0.11	0.7	0.03	0.57	0.77	1	0.22
MilkF	0.041	0.00053	0.16	0.71	0.013	0.042	0.41	0.52	0.19	0.17	0.19	0.03	0.77	0.71	0.47	0.014	1	1	0.74	0.75	1	0.2	0.22	0.33	0.3	0.75	1	0.24	0.79
Caramel	0.14	0.18	1	0.72	0.68	1	0.45	0.34	0.61	0.11	0.47	0.39	0.22	0.0041	0.091	0.41	0.3	0.26	0.75	0.54	0.076	0.36	0.043	0.61	0.0055	0.41	0.015	0.87	0.24
Vanilla	0.24	0.2	1	0.15	1	0.3	0.23	0.034	0.24	0.47	0.39	0.86	0.61	0.1	0.83	0.17	0.3	0.89	0.82	0.47	NaN	NaN	0.66	0.3	0.36	0.041	0.076	0.045	0.28
Sweetness	0.0041	0.01	0.084	0.49	0.74	1	0.038	0.65	0.042	0.17	0.091	0.58	0.17	0.7	0.055	0.013	0.58	0.16	0.2	0.31	0.89	0.14	0.41	0.19	0.017	0.12	0.64	0.36	0.69
Acidity	0.12	0.36	0.7	0.5	0.46	0.22	0.29	0.024	0.22	0.17	0.025	0.9	0.29	0.14	0.53	0.15	0.5	0.076	0.14	0.14	0.17	0.85	0.36	0.079	0.61	0.79	0.47	0.076	0.57
Bitterness	0.3	0.016	0.054	0.67	0.1	0.53	0.35	0.75	0.46	0.093	0.058	0.29	0.4	0.26	0.72	0.14	0.66	0.61	0.18	0.14	0.58	0.54	0.14	0.1	0.3	0.097	0.13	0.025	0.76
Astringency	0.46	NaN	0.041	1	0.36	0.22	0.76	0.12	0.74	0.38	0.61	0.17	0.38	0.61	0.091	0.41	0.12	0.14	0.19	0.1	0.082	0.2	0.058	0.64	0.45	0.39	0.72	0.48	0.22
Crunchy	0.55	0.042	0.2	0.7	0.16	1	0.73	1	0.23	0.36	0.32	0.11	0.14	0.7	0.0066	0.3	0.29	0.021	0.33	0.66	0.79	0.36	0.17	0.043	0.61	0.79	0.7	0.13	0.45
Melting	0.58	0.76	0.6	0.41	0.81	0.58	0.64	0.013	0.75	0.42	0.79	0.26	0.17	0.24	0.5	0.47	0.44	0.48	0.045	0.36	0.29	0.071	0.054	0.28	3.2e-74	0.54	0.81	0.069	0.14
Sticky	0.89	0.014	0.54	1	0.034	0.12	0.49	0.29	0.22	0.048	0.88	0.23	0.2	0.082	0.7	0.89	0.69	0.46	0.64	0.64	0.55	0.54	0.81	0.29	0.59	0.11	0.75	0.39	0.32
Granular	0.47	0.41	0.39	0.94	0.61	0.82	0.4	0.78	0.2	0.79	0.14	0.082	0.35	0.41	0.13	1	0.24	0.36	0.41	0.43	0.14	0.13	0.2	0.9	0.025	0.77	0.7	0.31	0.14

panelist performance: summary (10 first panelists only)

Panelist summary (Percentage)

	1	2	3	4	5	6	7	8	9	10
Discrimination	21.4	7.1	42.9	14.3	14.3	14.3	21.4	28.6	42.9	21.4
Reproducibility	100	85.7	100	78.6	100	92.9	35.7	71.4	100	100
Agreement	100	100	100	57.1	100	92.9	50	78.6	92.9	100
Cross Over	100	100	100	57.1	100	100	78.6	78.6	92.9	100
Scale	85.7	50	92.9	100	85.7	92.9	92.9	78.6	92.9	92.9

the R function

- name:
  - panelist.perf()
- information:
  - dataset, col.p, col.j, col.s, firstvar, lastvar=ncol(dataset)
- outputs:
  - panel=T (random=T),
  - discri=T, repro=T, agree=T, cross=F, correl=F, scal=F
- extra outputs
  - print.summary=T
  - extra.plot=F

about the program

- this program will be added to:
  - SensoMineR package (AgroCampus Ouest)
  - EyeQuestion (Logic8)

- the program is available for free @:
  - thierry@opp.nl

    or
  - delcher.raymond@wanadoo.fr

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