data cleaning principles

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Tidy data are all alike,
but every messy dataset
is messy in its own way.

– Hadley Wickham

If I clean up [Medicare] data ...
does any of the knowledge I gain ...
apply to the processing of RNA-seq data?

– Roger Peng

Data Mishaps Night

Join us for the first inaugural Data Mishaps Night!
We will feature a lineup of data mistake stories with
a focus on the human aspect of data work and
lessons learned the hard way.
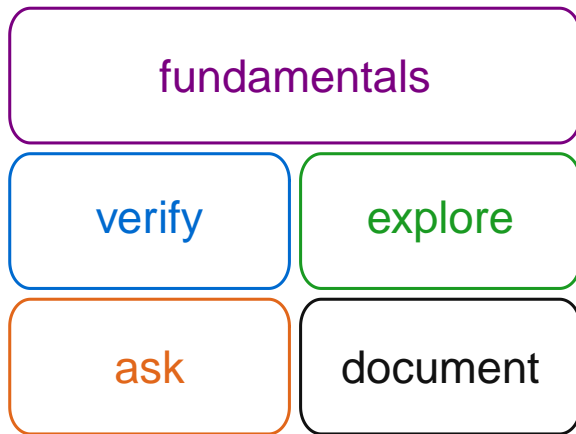
Caitlin Hudon & Laura Ellis
dataMishapsNight.com

Data cleaning

- tedious
- embarrassing
- needs context
- doesn't feel like progress

Data cleaning

- ▶ tedious
- ▶ embarrassing
- ▶ needs context
- ▶ doesn't feel like progress

- ▶ requires creativity
- ▶ requires coding prowess
- ▶ source of many problems

Data cleaning principles

fundamentals

1. Don't clean data when you're tired or hungry.

(paraphrasing Ghazal Gulati)

fundamentals

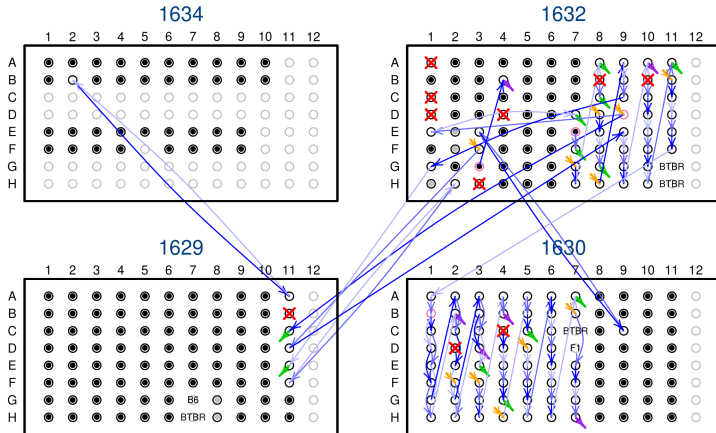2. Don't trust anyone (even yourself)

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"my motto is 'trust no one'
...except maybe @kwbroman?"

– Jenny Bryan

fundamentals

3. Think about what might have gone wrong and how it might be revealed

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fundamentals

4. Use care in merging

	A	B	C	D	E	F	G
1	id	glucose.0	glucose.5	glucose.15	glucose.30	insulin.0	insulin.5
2	DO–221	145.742786	206.452638	216.640608	299.55501	0.74455	2.0264
3	DO–222						
4	DO–223						
5	DO–224						
6	DO–225						
7	DO–226						
8	DO–227						
9	DO–228						
10	DO–229						
11	DO–230						

	A	B	C	D	E	F	G
1	id	glucose.0	insulin.0	glucose.5	insulin.5	glucose.15	insulin.15
2	DO–321	66.839405	0.04	246.685995	0.04	305.26214	0.04
3	DO–322	98.12509	0.51185	246.25574	1.4062	301.8201	2.828
4	DO–323	94.68305	1.7812	448.1068	1.0248	521.61894	1.02725
5	DO–324	121.051535	0.0882	407.355505	0.63475	470.541525	0.8195
6	DO–325	122.95695	0.19155	298.193665	0.6467	323.148455	0.40515
7	DO–326	201.447755	0.7454	386.51887	0.6081	654.99799	1.07225
8	DO–327	130.025425	0.0509	477.302675	0.166	610.49733	0.4842
9	DO–328	143.60919	0.23435	438.88705	0.70505	406.249135	0.2498
10	DO–329	125.29262	0.04	543.74634	1.7366	520.205245	0.8498
11	DO–330	135.61874	0.91275	393.03416	3.73095	454.62209	1.7325

5. Dates & categories suck

Principle:

a fundamental truth that guides our thinking

5. Dates & categories suck

6. Check that distinct things are distinct

	A	B	C	D	E	F	G
1	WiscID	ID	NEOID	Fem_CA	Fem_Imax	Fem_Imin	Fem_J
2	F2.C1W.F.1248	1248	NEO183	0.7524	0.1427	0.1006	0.2433
3	F2.C1W.M.1250	1250	NEO184	0.7669	0.1556	0.09652	0.2521
4	F2.C1W.F.1251	1251	NEO185	0.7613	0.1549	0.09659	0.2515
5	F2.C1W.F.1254	1254	NEO186	0.7475	0.1503	0.08603	0.2363
6	F2.C1W.M.1257	1257	NEO187	0.8197	0.1849	0.1056	0.2905
7	F2.___.F.715	715	NEO764	0.6017	0.09662	0.05969	0.1563
8	F2.___.F.751	751	NEO765	0.7273	0.1304	0.08735	0.2178
9	F2.___.F.1251	1251	NEO766	0.6675	0.1157	0.07814	0.1938
10	F2.___.M.1340	1340	NEO768	0.6656	0.1387	0.08122	0.2199
11	F2.C1W.M.739	739	NEO779	0.9336	0.2828	0.1628	0.4456

verify

7. Check that matching things match

	A	B	C	D
1	id	sex	n_gen	age_days
2	F20.25	M	20	75
3	F21.30	M	21	75
4	F21.68	M	21	71
5	F22.52	M	22	73
6	F21.71	F	**22**	63
7	F22.116	F	22	57
8	F21.F20.9.M5	M	20	82
9	F21.F20.18.M5	M	20	77
10	F20.26	M	20	75
11	F21.62	M	21	72

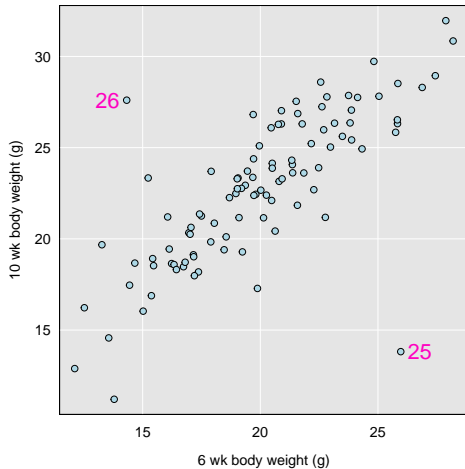|	A	B	C	D
1	id	sex	age_at_dosing	n_gen
2	F22.69	F	67	22
3	F22.106	F	69	22
4	F22.70	F	67	22
5	F22.107	F	69	22
6	F21.71	F	65	**21**
7	F22.116	F	62	22
8	F22.73	F	65	22
9	F22.117	F	62	22
10	F21.108	F	62	21
11	F22.118	F	59	22
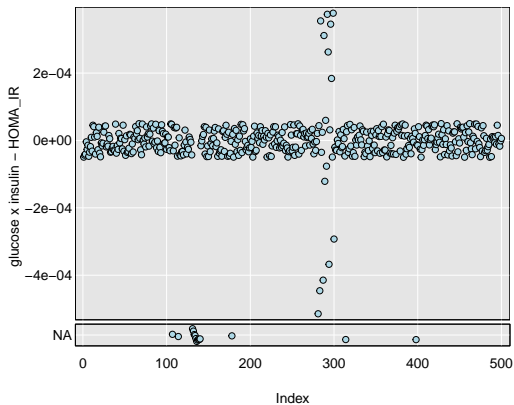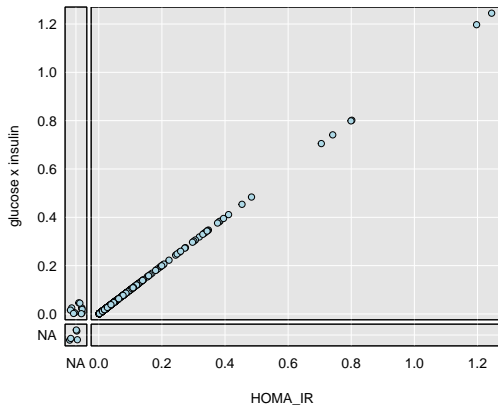
verify

9. Look for other instances of a problem
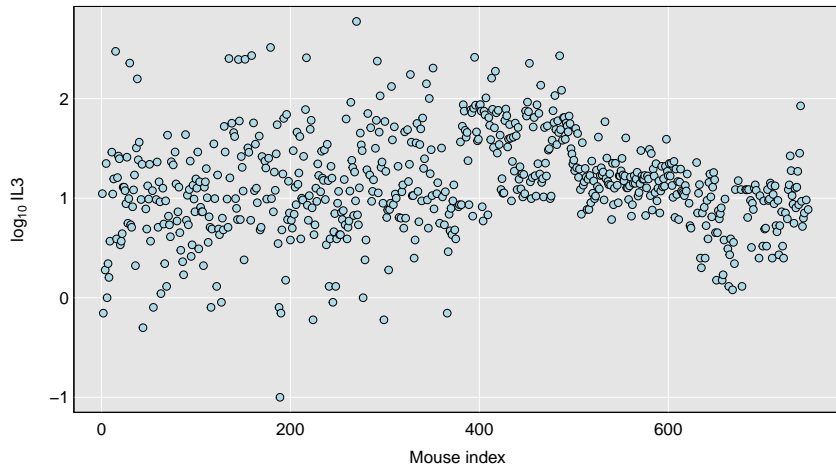
10. Make lots of plots

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explore

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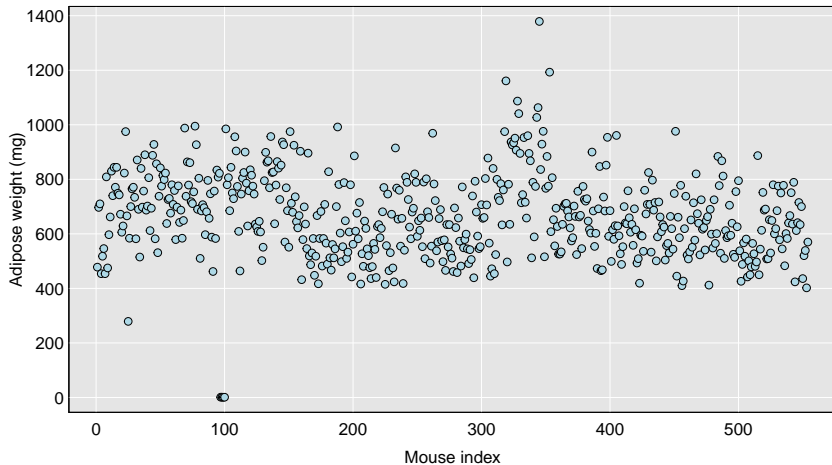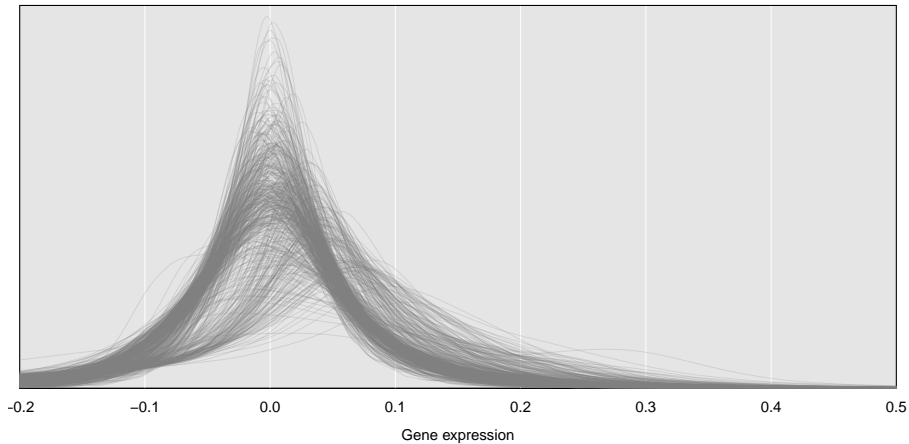
explore

{visdat}

{naniar}

12. With massive data,
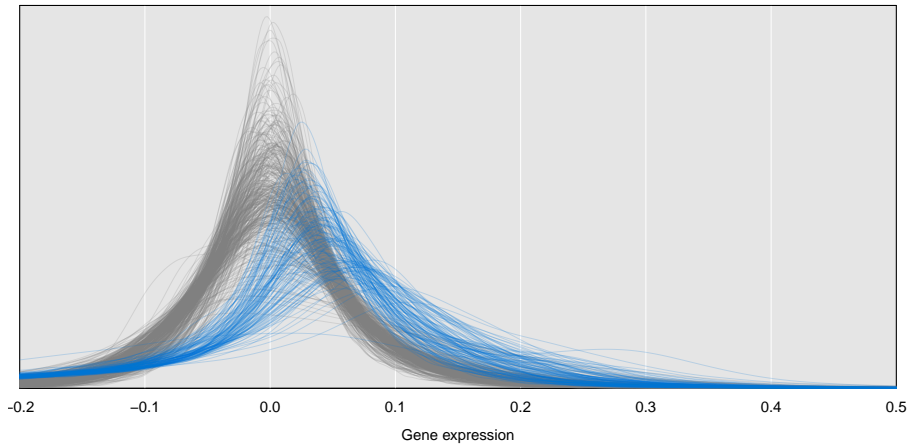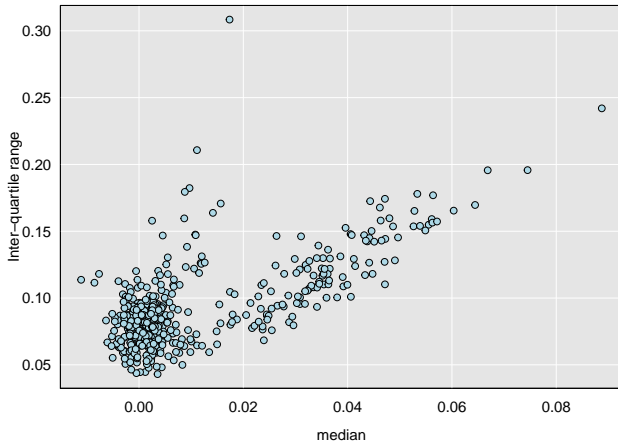make more plots not fewer

Gene expression

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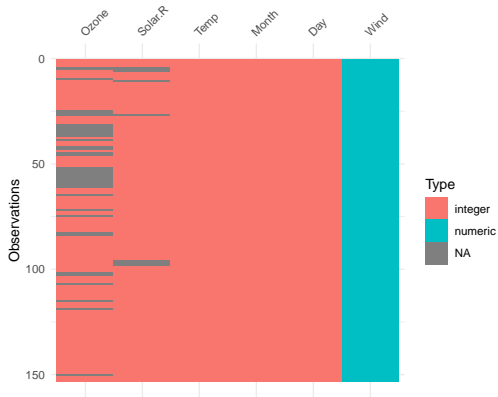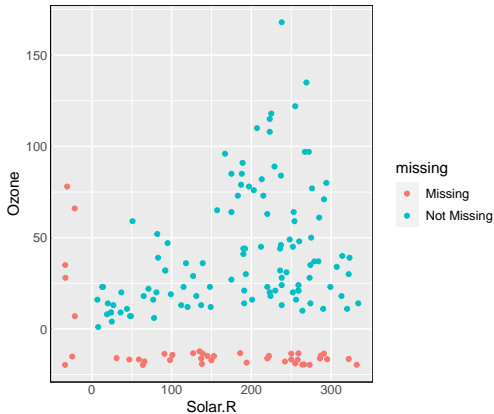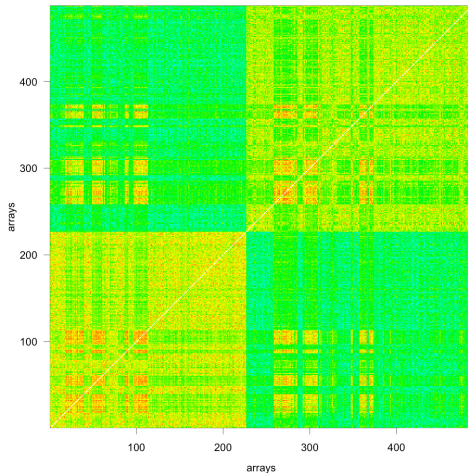
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14. Ask questions

15. Ask for the primary data

16. Ask for metadata

17. Ask why data are missing

document

18. Create checklists & pipelines

19. Document not just what but why

20. Expect to recheck

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8. Check calculations
9. Look for other instances of problems

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11. Look at missing value patterns
12. With big data make more plots
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I will let the data speak for itself
when it cleans itself.

– Allison Reichel

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