Modeling as data compression

- the model is a concise representation of the data
- exact model $\leftrightarrow$ lossless compression (*e.g.*, `zip`)
- approximate model $\leftrightarrow$ lossy compression (*e.g.*, `mp3`)

Example: compression of a random vector

- data: $1 \times n$ vector, generated by `randn`
- compression in `mat` format

	length n	1	223	334	556	667	1000
1.	original size	8	1784	2672	4448	5336	8000
2.	mat file size	178	1945	2798	4490	5341	7893

Example: low-rank matrix compression

- data: random 100×100 matrix D of rank 5
- stored in four different ways

	representation	size
1.	all elements of D	80000
2.	D in `mat` format	75882
3.	all elements of P and L	8024
4.	P and L in `mat` format	7767

- in 2 and 4, we compute a rank revealing factorization

$$D = PL$$

- can we do better than storing P and L (compressed)?

Example: trajectory of an LTI system

- data: impulse response of a random 3rd order system
- stored in four different ways

	representation	size
1.	impulse response h	192
2.	h in `mat` format	377
3.	model parameters θ	56
4.	θ in `mat` format	233

- in 3 and 4, we have parameterized the system