Data Dwarf

University of California: Santa Barbara

2015 Senior Computer Science Capstone Project

Team Members:

Sean Spearman
Cody Brown
Ray Smets
Aimee Galang
Tim Shen

Data is Valuable

The Problem

1. Data’s format is hard to understand.

2. Finding relationships is tedious and not guaranteed.

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	A	B	C	D	E	F
1	Date	Internet Users (per 100 People)	Rural Population (% of total population)	US Household Final Consumption Expenditure PPP (current international $)	US Unemployment Rate (% of Total Labor Force)	Age Dependency Ratio (% of Working-Age Population)
2	12/31/2013	84.2	18.723	1.14843E+13	7.35	50.39534096
3	12/31/2012	79.3	18.892	1.10831E+13	8.075	49.83963833
4	12/31/2011	69.72946076	19.06	1.06893E+13	8.933	49.38454487
5	12/31/2010	71.69	19.228	1.02022E+13	9.625	49.03995685
6	12/31/2009	71	19.394	9.847E+12	9.283	48.81001789
7	12/31/2008	74	19.562	1.00136E+13	5.8	48.689405
8	12/31/2007	75	19.731	9.7505E+12	4.617	48.67564802
9	12/31/2006	68.93119327	19.901	9.304E+12	4.608	48.76268507
10	12/31/2005	67.96805292	20.072	8.7941E+12	5.083	48.94280961
11	12/31/2004	64.75825648	20.243	8.26E+12	5.542	49.21455249
12	12/31/2003	61.69711712	20.417	7.7655E+12	5.992	49.56972092
13	12/31/2002	58.78540388	20.591	7.3841E+12	5.783	49.98365968
14	12/31/2001	49.08083159	20.766	7.1031E+12	4.742	50.42393238
15	12/31/2000	43.07916264	20.943	6.7924E+12	3.967	50.86247379
16	12/31/1999	35.84872446	21.258	6.307E+12	4.217	51.29067669
17	12/31/1998	30.09319659	21.623	5.903E+12	4.5	51.70052723
18	12/31/1997	21.61640097	21.992	5.5607E+12	4.942	52.06392098
19	12/31/1996	16.41935296	22.364	5.2681E+12	5.408	52.34669698
20	12/31/1995	9.237088297	22.743	4.9842E+12	5.592	52.52296438
21	12/31/1994	4.862780635	23.125	4.741E+12	6.1	52.57795283
22	12/31/1993	2.271673294	23.512	4.471E+12	6.908	52.51600601
23	12/31/1992	1.724202539	23.903	4.2157E+12	7.492	52.35597463
24	12/31/1991	1.163193726	24.299	3.9602E+12	6.85	52.12947135
25	12/31/1990	0.784728502	24.7	3.8256E+12	5.617	51.86500605
26	12/31/1989	n.a.	24.911	3.5928E+12	5.258	51.57014711
27	12/31/1988	n.a.	25.058	3.3469E+12	5.492	51.25318383
28	12/31/1987	n.a.	25.207	3.0921E+12	6.175	50.9462661
29	12/31/1986	n.a.	25.356	2.8984E+12	7	50.68849122
30	12/31/1985	n.a.	25.506	2.7226E+12	7.192	50.51191344
31	12/31/1984	n.a.	25.656	2.4981E+12	7.508	50.431508
32	12/31/1983	n.a.	25.806	2.2865E+12	9.6	50.45404956
33	12/31/1982	n.a.	25.958	2.0739E+12	9.708	50.59283254
34	12/31/1981	n.a.	26.11	1.9375E+12	7.617	50.85913991
35	12/31/1980	n.a.	26.262	1.7546E+12	7.175	51.26088467
36	12/31/1979	n.a.	26.308	n.a.	n.a.	51.80449825

Datasets sourced from *World Bank Cross Country Data* and *ILOSTAT Database* through *Quandl*

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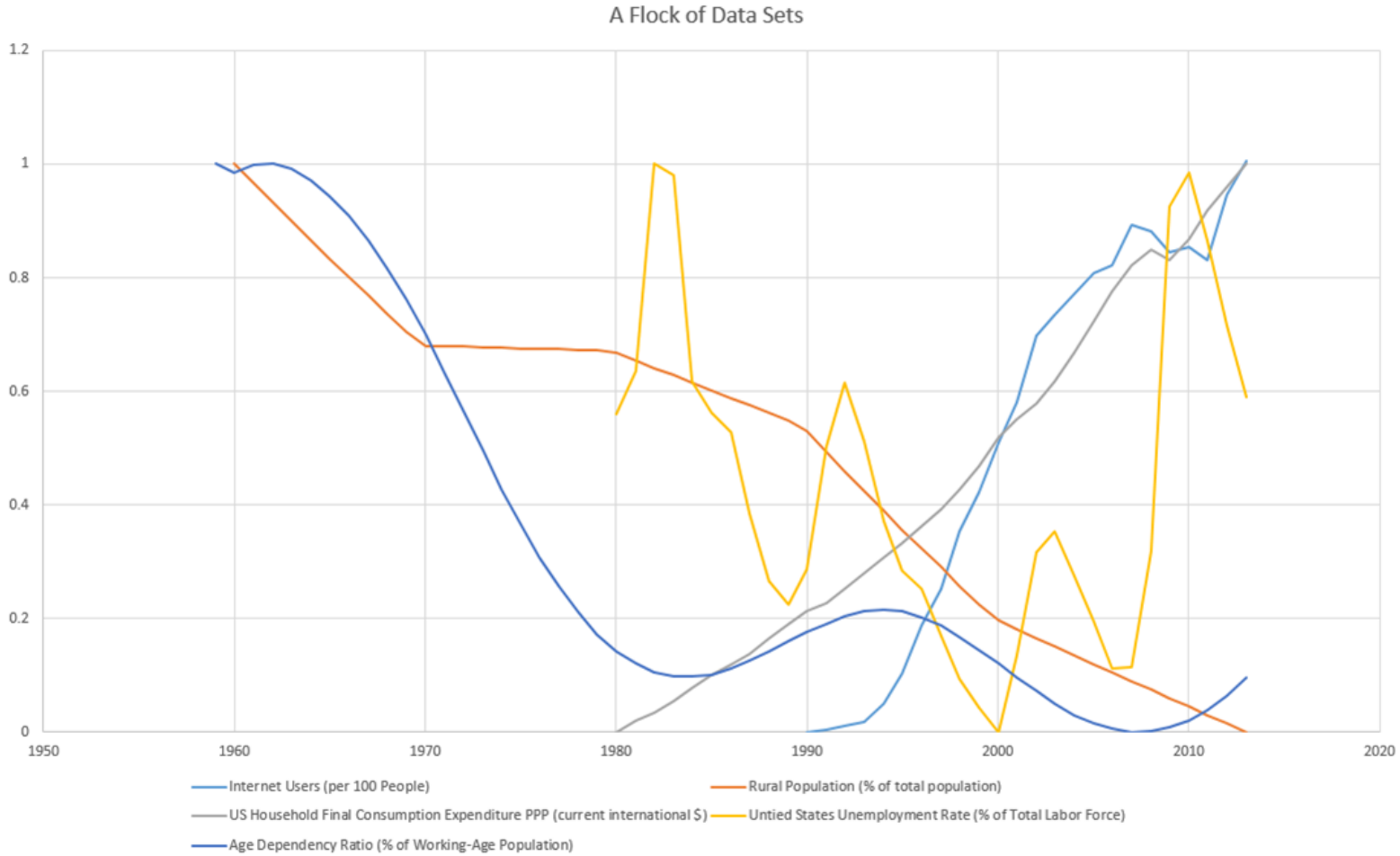

A Flock of Data Sets
1.2
1
0.8
0.6
0.4
0.2
0
1950
1960
1970
1980
1990
2000
2010
2020
Internet Users (per 100 People)
Rural Population (% of total population)
US Household Final Consumption Expenditure PPP (current international $)
Untied States Unemployment Rate (% of Total Labor Force)
Age Dependency Ratio (% of Working-Age Population)

Correlation Indicates Potentially Meaningful Relationships

DataDwarf

Technology

Front End

Back End

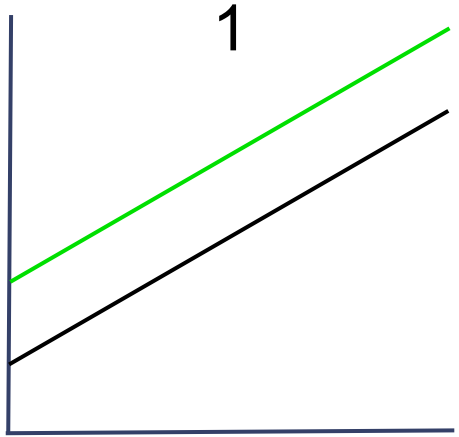
Data Source

Teamwork

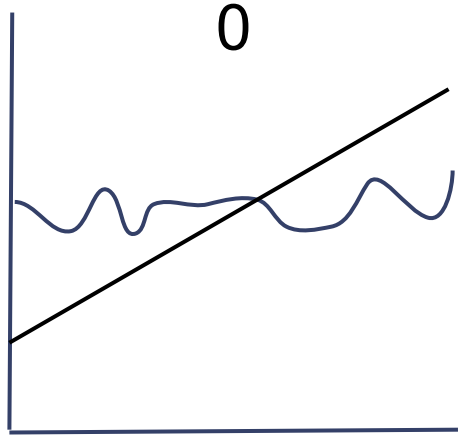
Correlation Value Usage

- **Input:** 2 datasets
- **Output:** one number
- **Want to know:** how similar they are

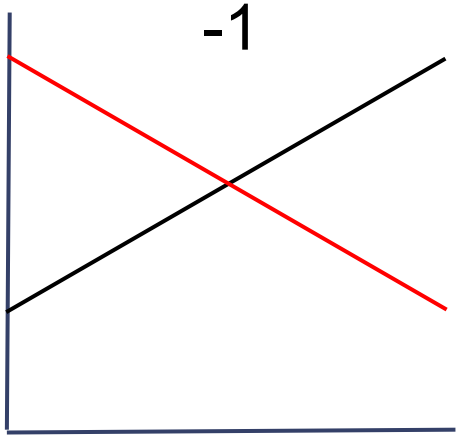
Correlation Range



Directly correlated



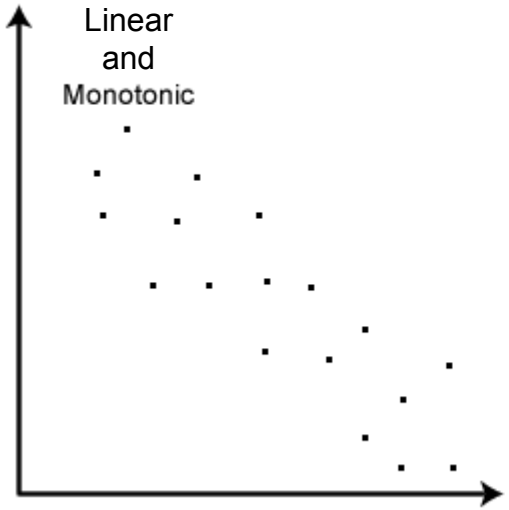
Not correlated



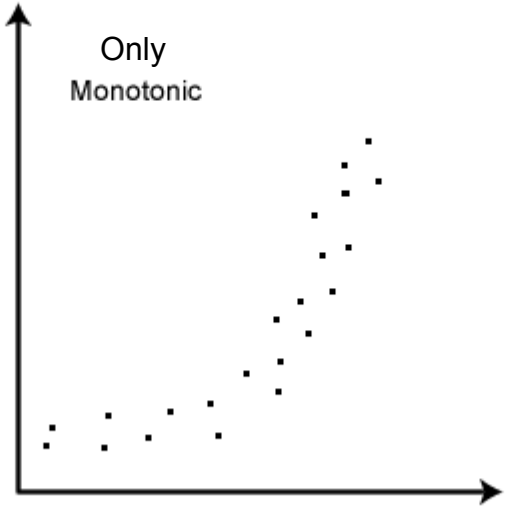
Inversely correlated

Pearson vs (Spearman or Kendall)

use Pearson

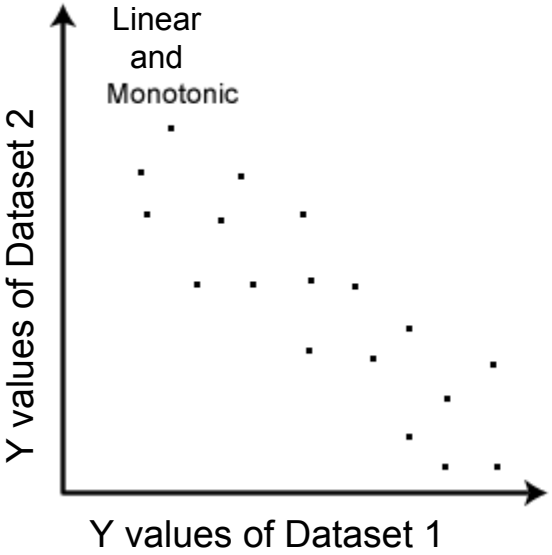


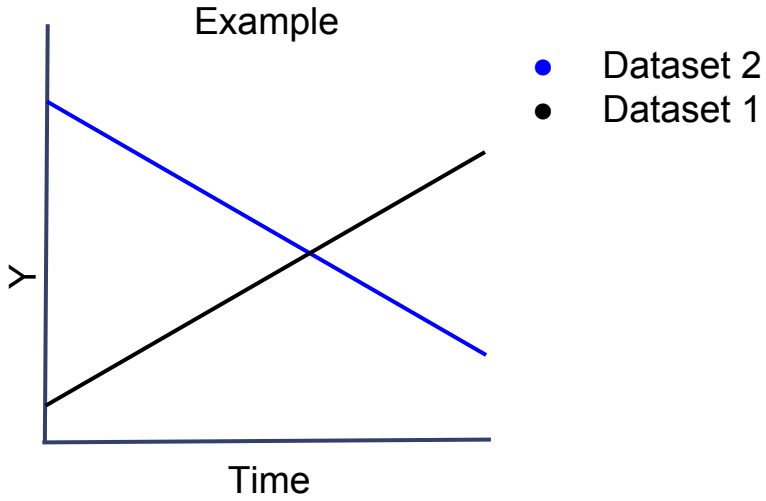
use Spearman or Kendall



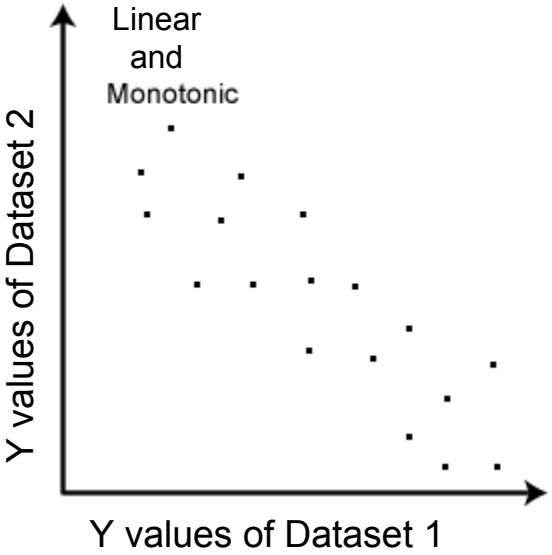
https://statistics.laerd.com/statistical-guides/spearmans-rank-order-correlation-statistical-guide.php

Pearson


Linear
and
Monotonic
Y values of Dataset 2
Y values of Dataset 1


Example
Dataset 2
Dataset 1
Y
Time

Pearson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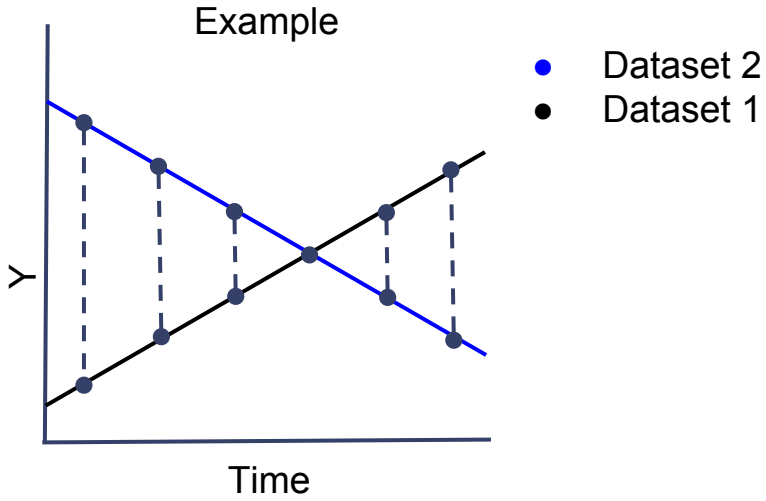
Example
Dataset 2
Dataset 1
Y
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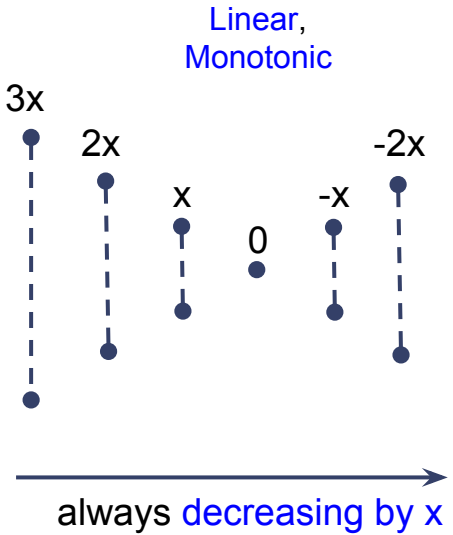
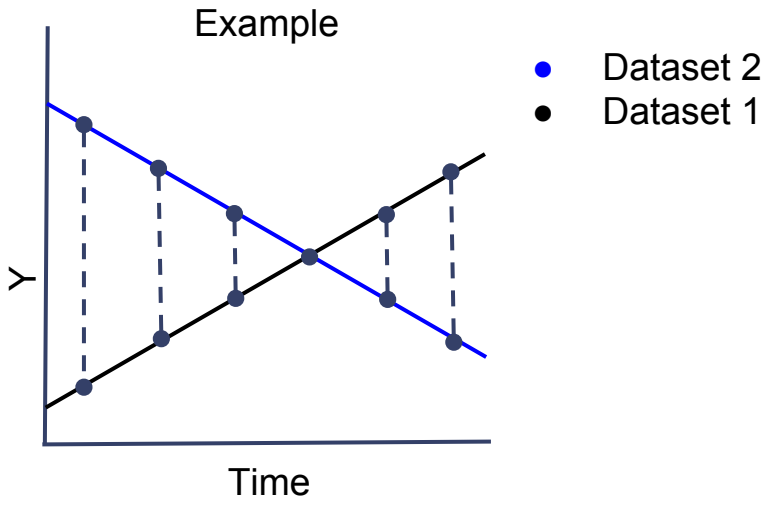
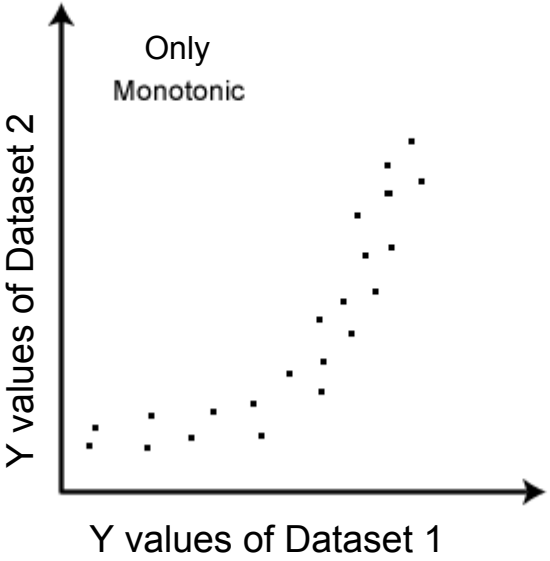
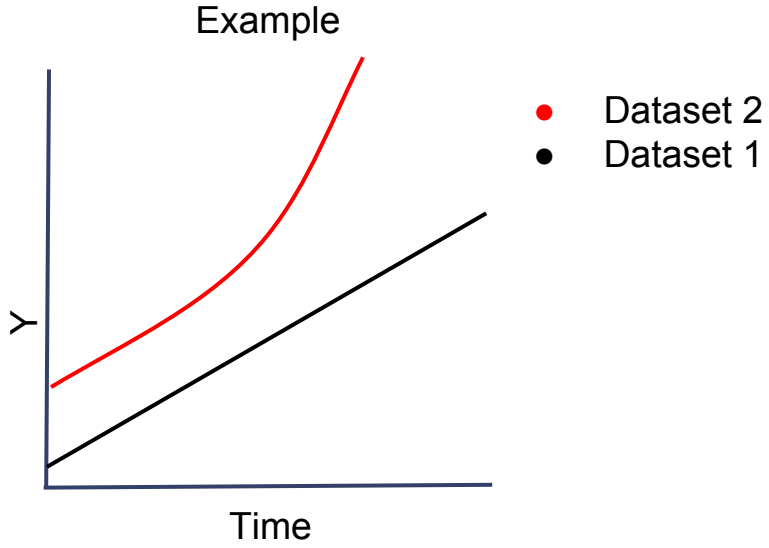
Pearson


Linear,
Monotonic
3x
2x
x
0
-x
-2x
always decreasing by x


Example
Y
Time
Dataset 2
Dataset 1

Spearman and Kendall





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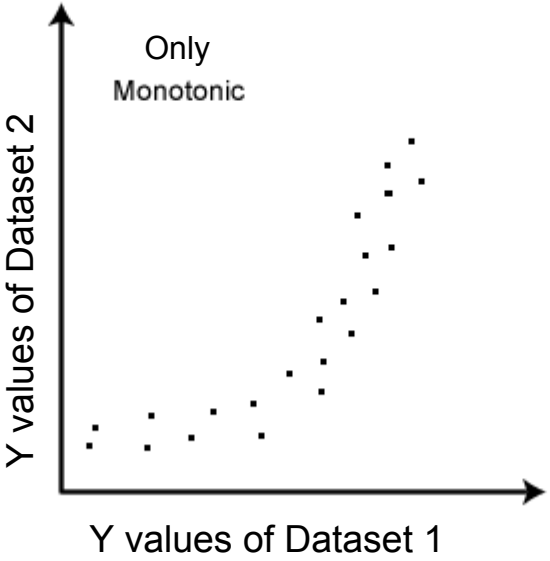
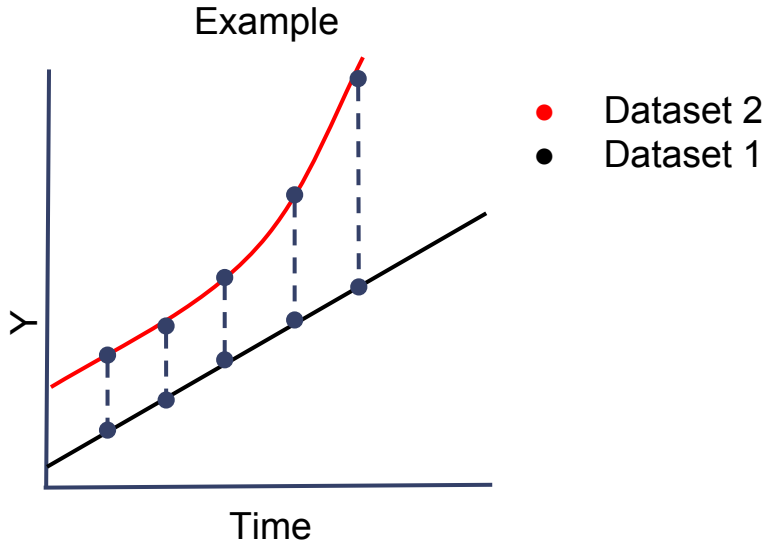
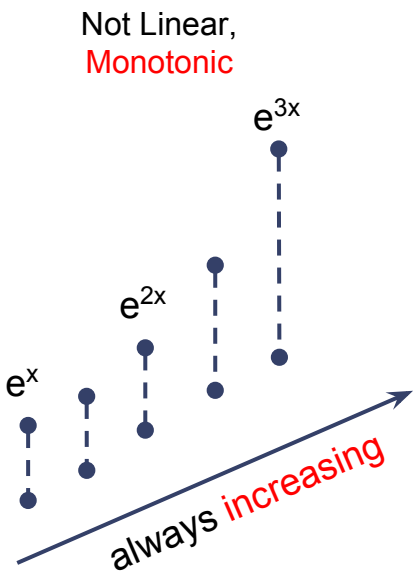
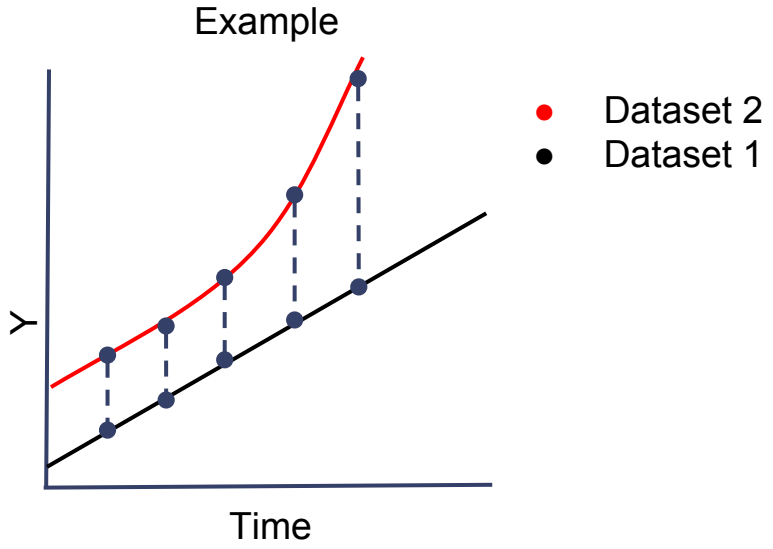


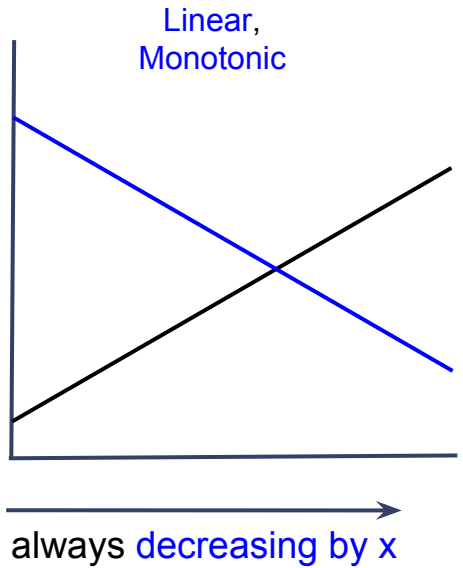


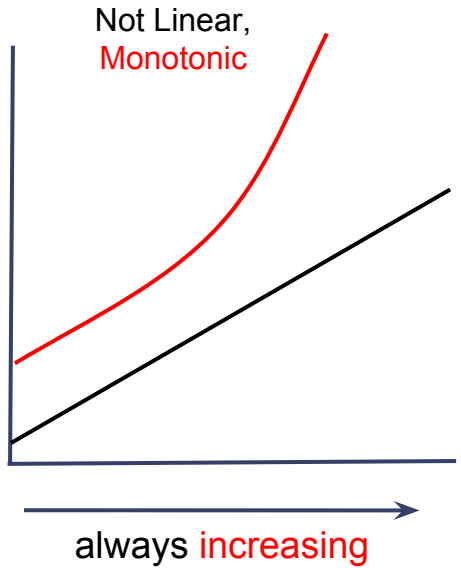
Spearman and Kendall





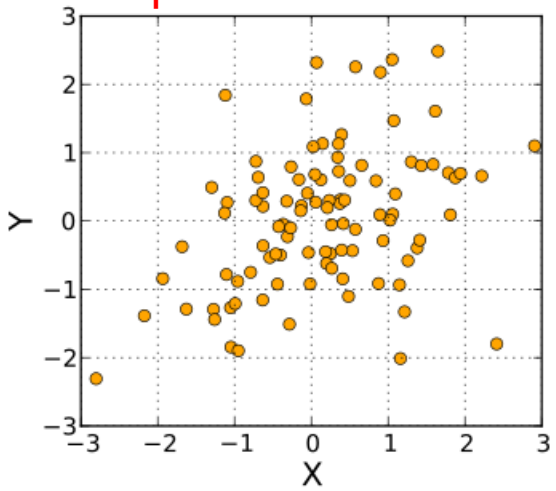
Pearson vs (Spearman and Kendall)



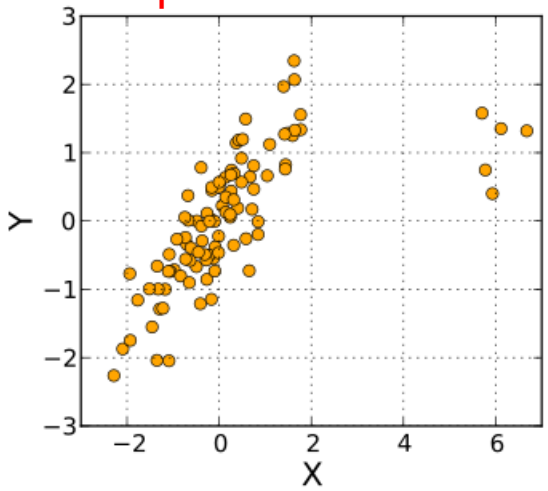


Pearson vs Spearman

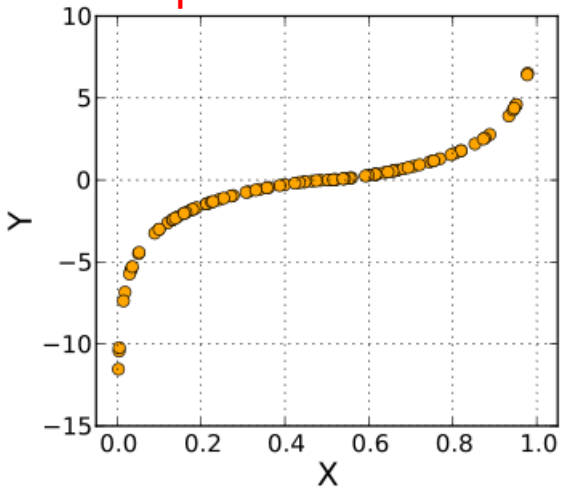
Pearson = 0.37
Spearman = 0.35



Pearson = 0.67
Spearman = 0.84

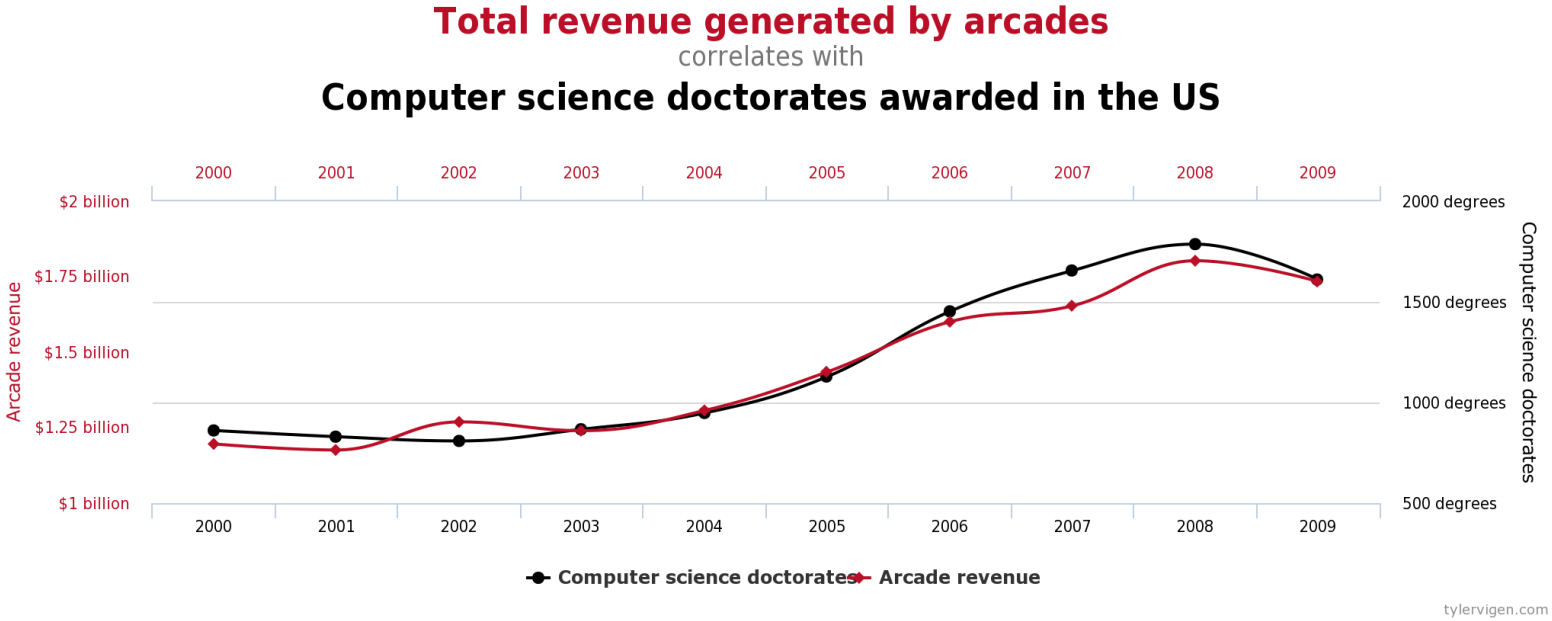


Pearson = 0.88
Spearman = 1



http://en.wikipedia.org/wiki/Spearman%27s_rank_correlation_coefficient

Spurious Correlation Example



Demo

Bring your own data (BYOD) to DataDwarf.io