IMD0033 - Probabilidade

Aula 21 - Correlação e covariância

Ivanovitch Silva

Junho, 2019

Agenda

- Correlação e covariância
- Coeficiente de correlação

Atualizar o repositório

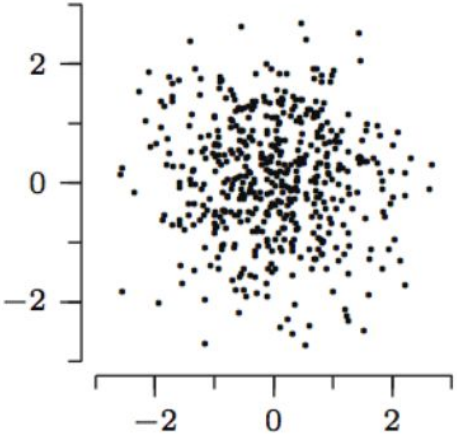
```
git clone https://github.com/ivanovitchm/imd0033_2019_1.git
```

Ou ....

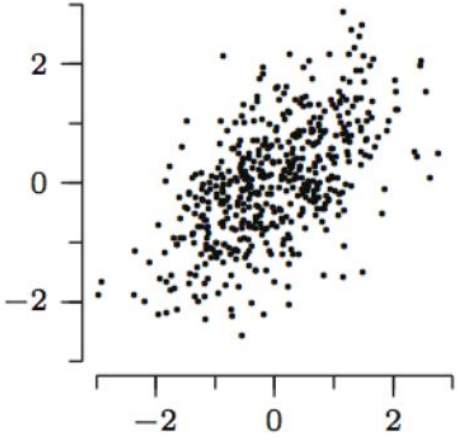
```
git pull
```

Types of correlation and intensity

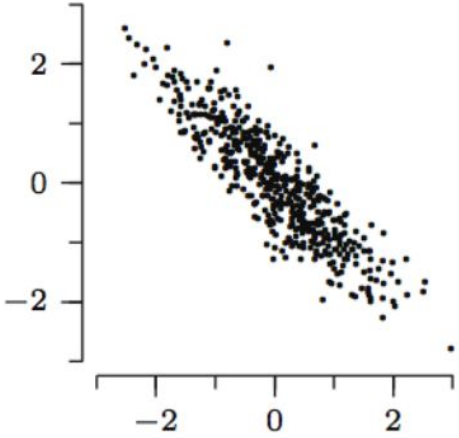
Gráficos de Dispersão



No correlation

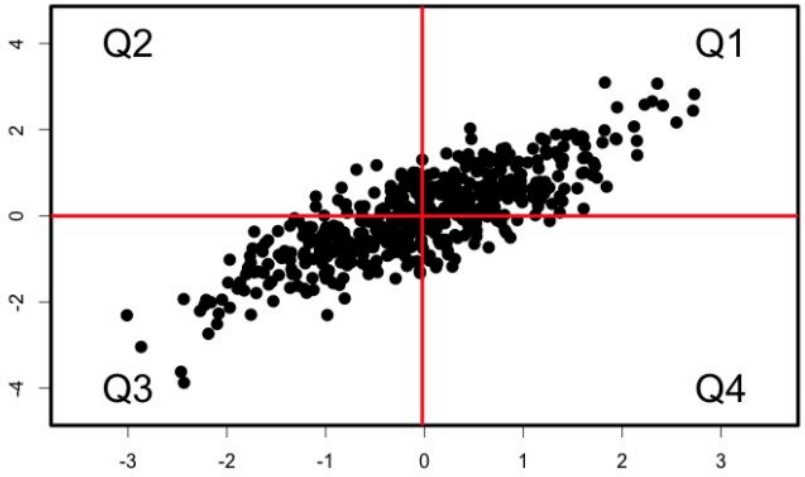


Weak positive correlation



Strong negative correlation

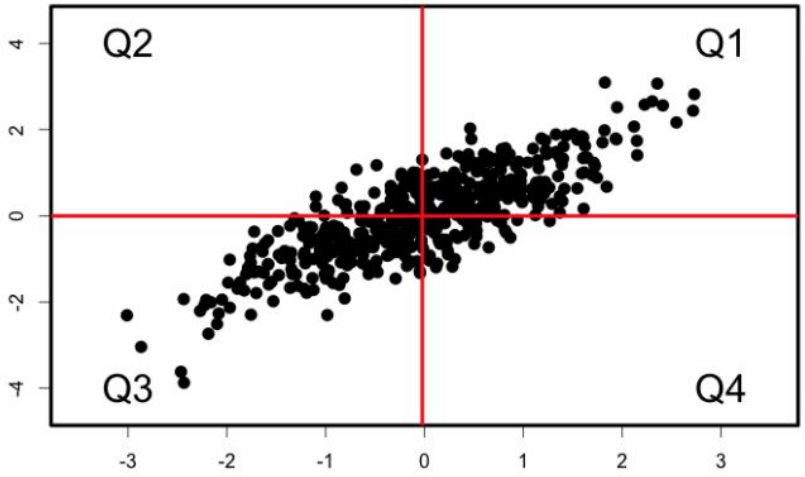
Analyzing scatter plot



It is possible to include in the scatter plot the vertical and horizontal lines that pass, respectively, by the sample means $\bar{x}$ and $\bar{y}$

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad \bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i$$

Analyzing scatter plot



$(x_i - \bar{x})$ Average deviation for variable x

$(y_i - \bar{y})$ Average deviation for variable y

$(x_i - \bar{x})(y_i - \bar{y})$ Deviation product

What is the behavior for deviation product in Q1, Q2, Q3, Q4?

Covariance

Covariance refers to how different numbers vary jointly

$$cov(\mathbf{x}, \mathbf{y}) = \frac{\sum_{i=1}^{n}(x_i - \mu_x)(y_i - \mu_y)}{n}$$

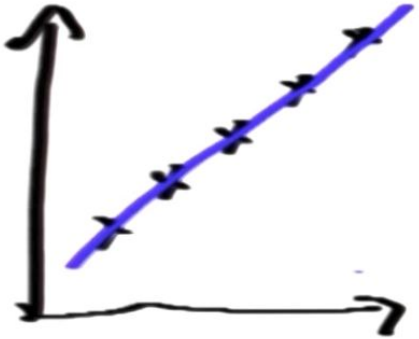
Correlation coefficient

Covariance, however, does not provide a measure of the intensity of the relationship, since it depends on the units in which the variables are expressed. One way around this problem is by standardizing the data

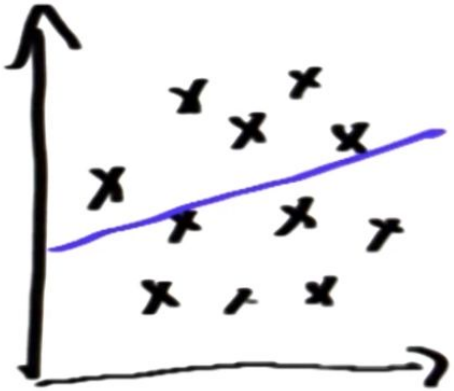
$$\frac{cov(\mathbf{x},\mathbf{y})}{\sigma_x \sigma_y}$$

Correlation Coefficient

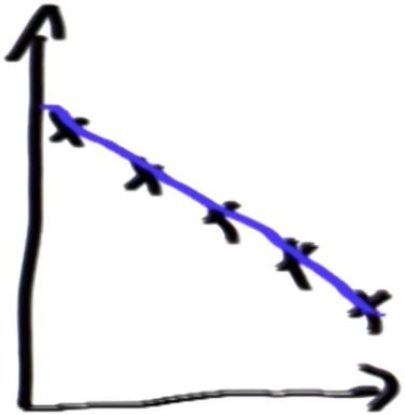
$\in [-1 \ldots 1]$



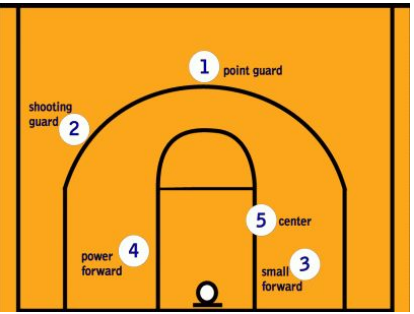
$r = 1$



0



-1



Case Study

	player	pos	age	bref_team_id	g	gs	mp	fg	fga	fg.	...	drb	trb	ast	stl	blk	tov	pf	pts	season	sea
0	Quincy Acy	SF	23	TOT	63	0	847	66	141	0.468	...	144	216	28	23	26	30	122	171	2013-2014	
1	Steven Adams	C	20	OKC	81	20	1197	93	185	0.503	...	190	332	43	40	57	71	203	265	2013-2014	
2	Jeff Adrien	PF	27	TOT	53	12	961	143	275	0.520	...	204	306	38	24	36	39	108	362	2013-2014	
3	Arron Afflalo	SG	28	ORL	73	73	2552	464	1011	0.459	...	230	262	248	35	3	146	136	1330	2013-2014	
4	Alexis Ajinca	C	25	NOP	56	30	951	136	249	0.546	...	183	277	40	23	46	63	187	328	2013-2014	

g - número de jogos
gs - jogos como titular
mp - minutos jogados/partida
fg - lançamentos feitos
fga - tentativas de lançamentos
fg. - eficiência

drb - rebotes defensivos
trb - total de rebotes
ast - assistência por jogo
stl - roubadas de bola
pf - faltas pessoais
pts - pontos

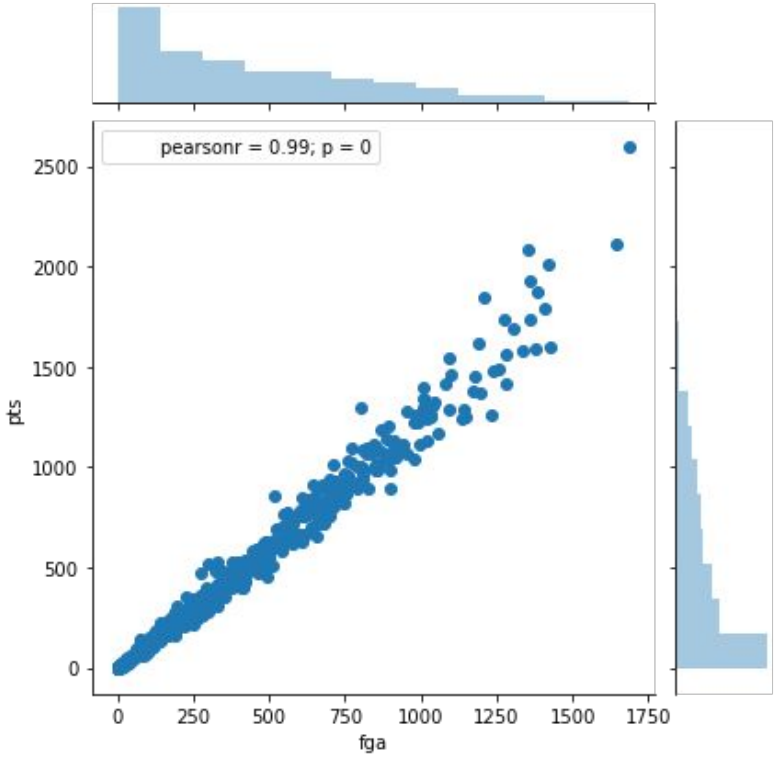
http://stats.nba.com/help/glossary/

Pearsonr

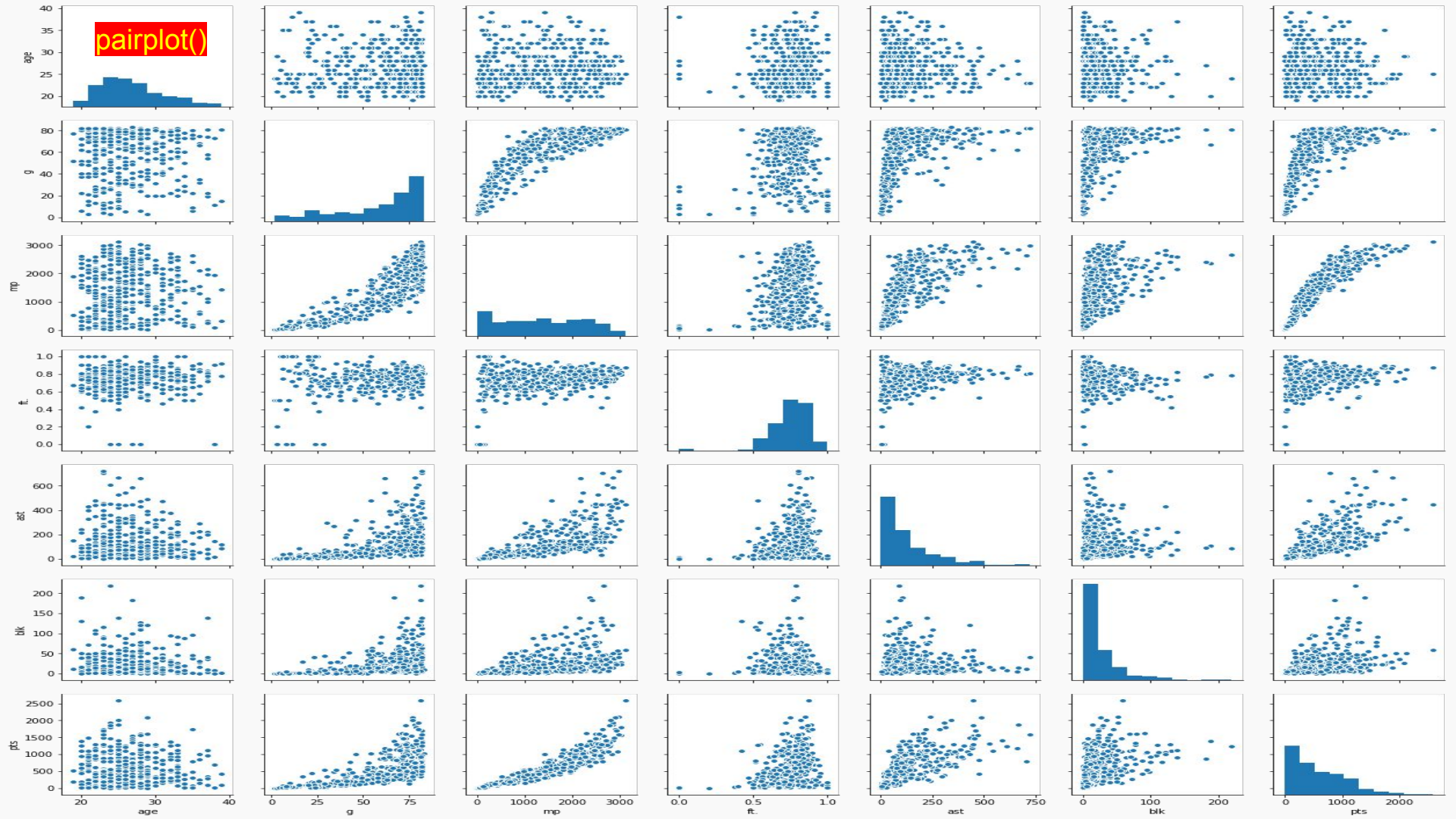
```
from scipy.stats.stats import pearsonr

# The pearsonr function will find the correlation between two columns of data.
# It returns the r value and the p value.  We'll learn more about p values later on.
r, p_value = pearsonr(nba["fga"], nba["pts"])
```

Seaborn Jointplot

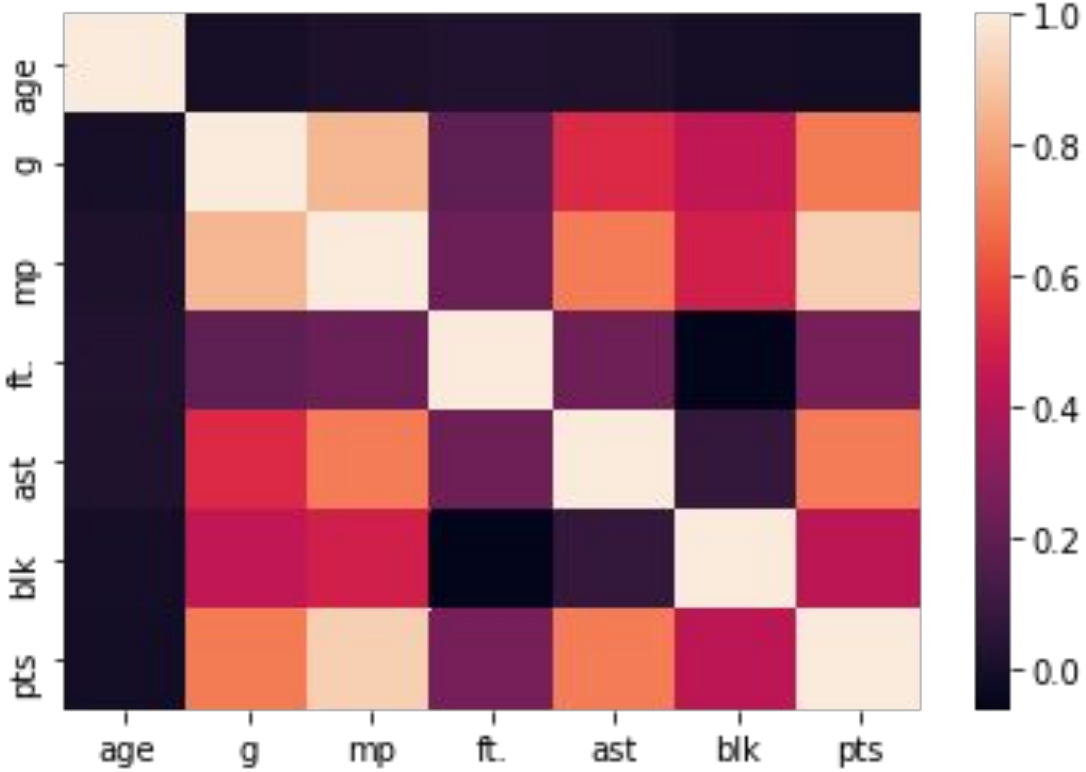



```
# Draw a plot of two variables
# with bivariate and univariate graphs.
sns.jointplot(x=nba["fga"], y=nba["pts"])
```


pairplot()
age
g
mp
ft.
ast
blk
pts

```
columns = ['age', 'g', 'mp', 'ft.', 'ast', 'blk','pts']
nba[columns].corr()
```

	age	g	mp	ft.	ast	blk	pts
age	1.000000	0.003149	0.019843	0.033372	0.026157	0.001864	-0.007520
g	0.003149	1.000000	0.855091	0.198547	0.520201	0.444877	0.708630
mp	0.019843	0.855091	1.000000	0.232772	0.711095	0.489242	0.920194
ft.	0.033372	0.198547	0.232772	1.000000	0.235162	-0.060122	0.258744
ast	0.026157	0.520201	0.711095	0.235162	1.000000	0.083110	0.710765
blk	0.001864	0.444877	0.489242	-0.060122	0.083110	1.000000	0.432895
pts	-0.007520	0.708630	0.920194	0.258744	0.710765	0.432895	1.000000




```
sns.heatmap(nba[columns].corr())
```

https://github.com/henriquepgomide/caRtola

https://www.nytimes.com/2019/05/22/magazine/soccer-data-liverpool.html


MacBook Pro