Social Data Science: Machine Learning & Econometrics

Exercise class 8

February 7, 2020

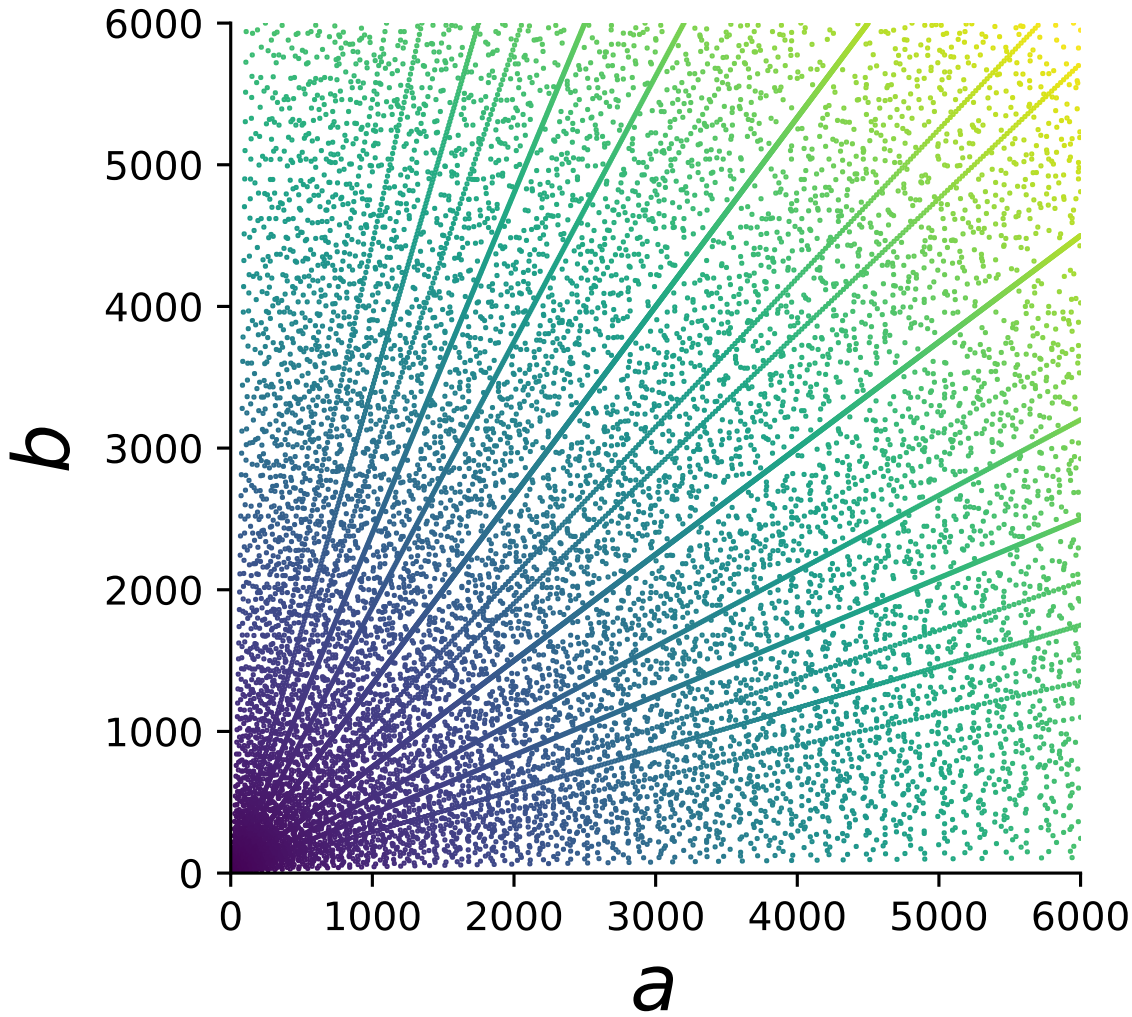
Todays quick warmup

A Pythagorean triple is a tuple $(a, b, c) \in \mathbb{N}^3$ such that $a^2 + b^2 = c^2$. For example the triple $(3, 4, 5)$ is a Pythagorean triple.

$\mathbf{Q}_1$: show that if (a, b, c) is a Pythagorean triple, so is (qa, qb, qc), $q \in \mathbb{N}$.

$\mathbf{Q}_2$: Plot in (a, b) space all Pythagorean triples with $a, b < 10.000$.

Todays quick warmup - solution



Todays quick warmup - solution

Q'$_1$: We know a, b, c and q are integers; so are qa, qb and qc. Multiply q^2 on both sides of $a^2 + b^2 = c^2$ to see that $(qa)^2 + (qb)^2 = (qc)^2$ holds.
Q'$_2$: Work backwards, simply check if c is integer for all combinations a, b:

```
triples = [
    (a, b, np.sqrt(a**2 + b**2))
    for a in range(1,6001)
    for b in range(1,6001)
    if np.sqrt(a**2 + b**2).is_integer()
]
a,b,c = [list(x) for x in zip(*triples)]

fig, ax = plt.subplots()
ax.scatter(a,b,c=c, marker = 's', s = .2)
ax.set_xlabel('$a$', fontsize = 20)
ax.set_ylabel('$b$', fontsize = 20)
ax.set_xlim(0,6000)
ax.set_ylim(0,6000)
```