Analysis of Titanic data

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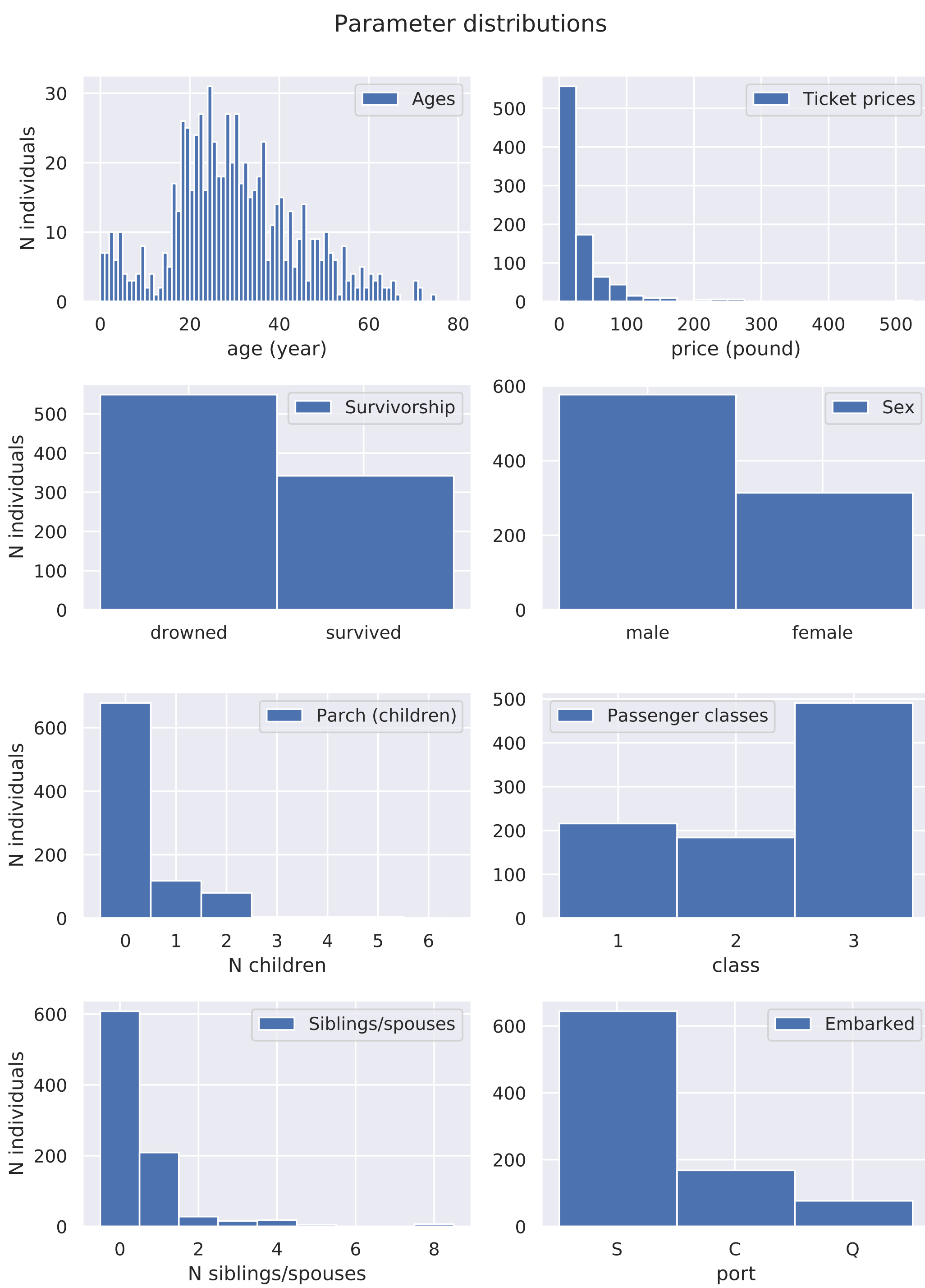
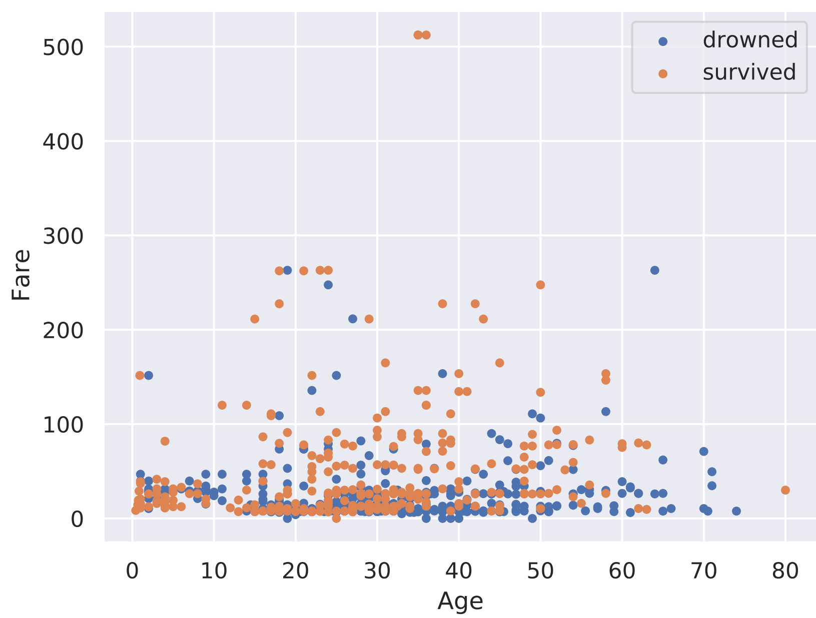
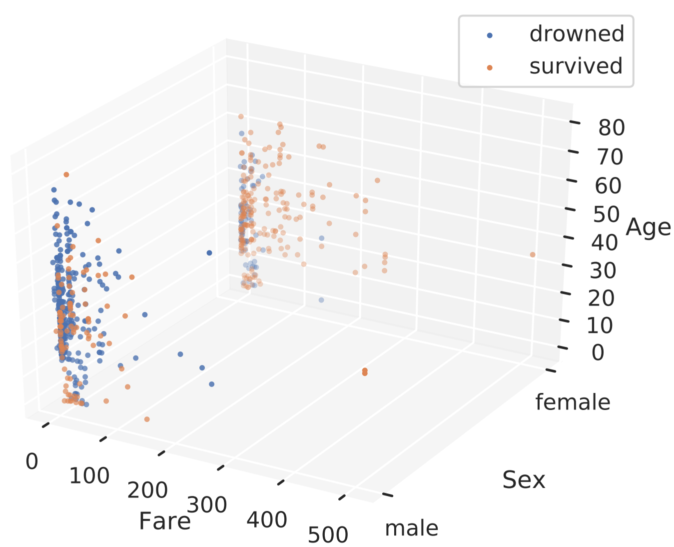
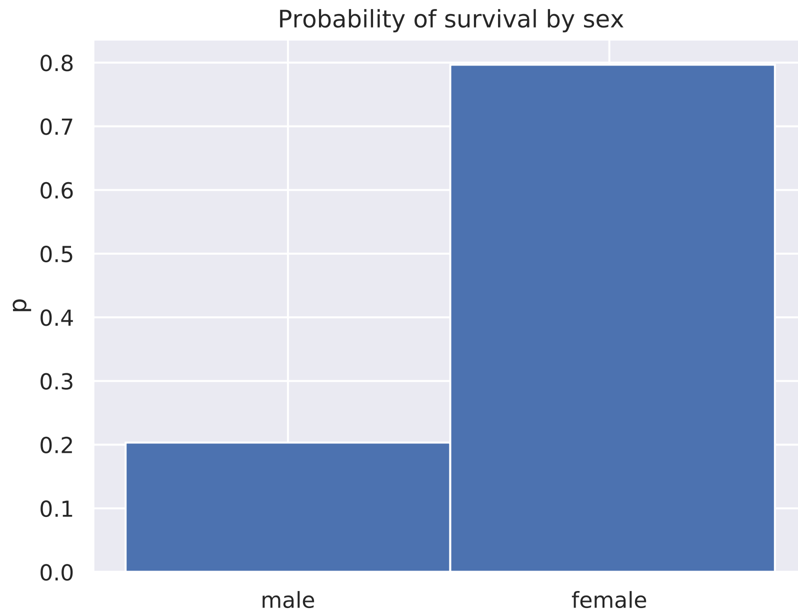
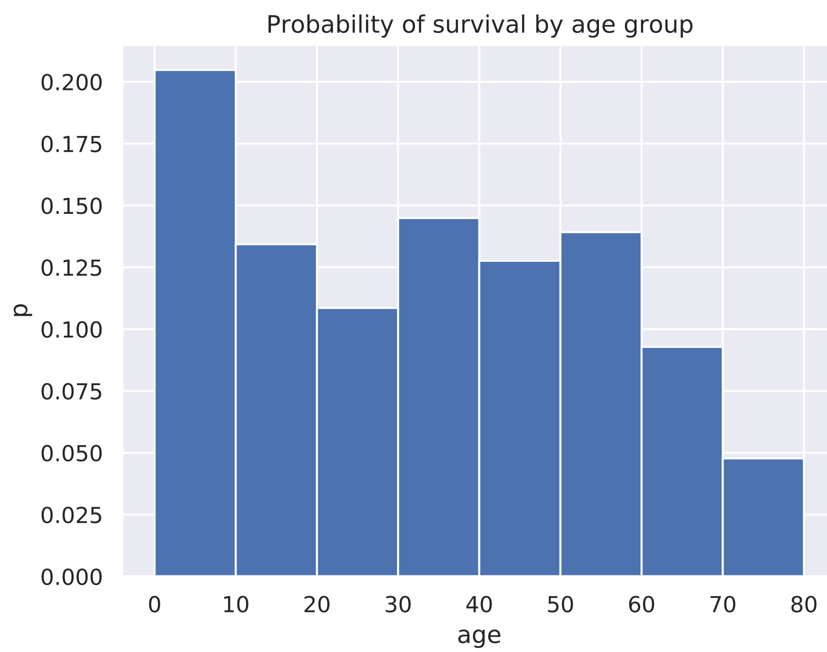
Last update: September 12, 2021

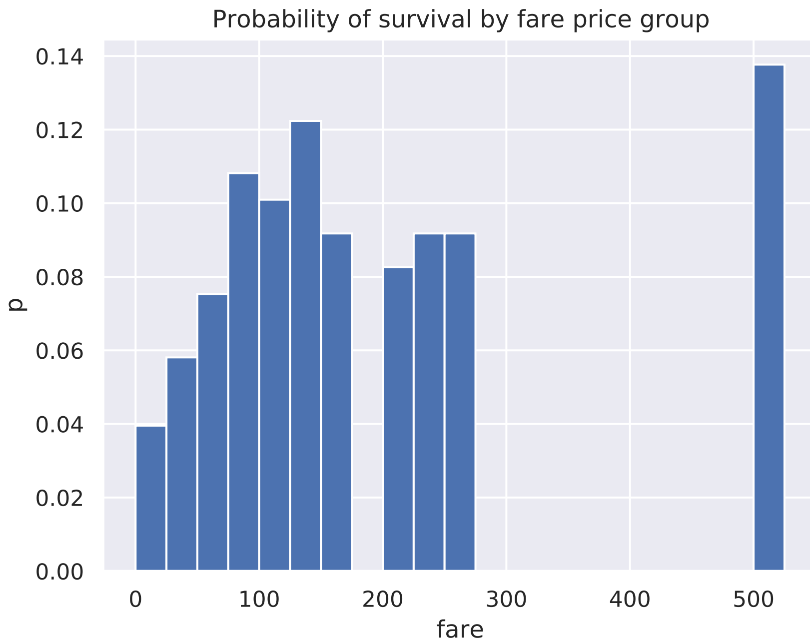

Parameter distributions
Ages
N individuals
age (year)
Ticket prices
price (pound)
Survivorship
drowned
survived
Sex
male
female
Parch (children)
N children
Passenger classes
class
Siblings/spouses
N siblings/spouses
Embarked
S
C
Q
port

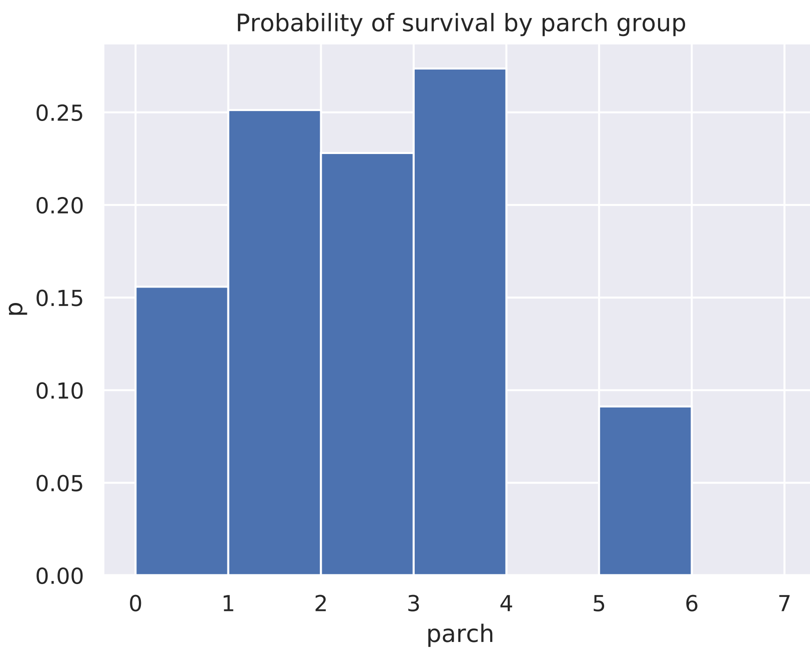

drowned
survived
500
400
300
200
100
0
Fare
0
10
20
30
40
50
60
70
80
Age


drowned
survived
80
70
60
50
40
30
20
10
0
Age
female
Sex
male
0
100
200
300
400
500
Fare


Probability of survival by sex
p
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
male
female

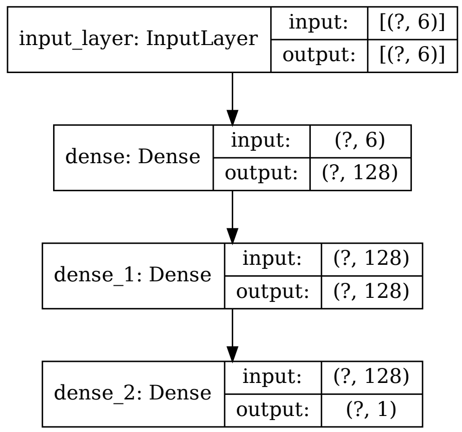

Probability of survival by age group
p
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0
10
20
30
40
50
60
70
80
age


Probability of survival by fare price group
p
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0
100
200
300
400
500
fare


Probability of survival by parch group
p
0.00
0.05
0.10
0.15
0.20
0.25
0
1
2
3
4
5
6
7
parch

Training a neural network to predict survival

Need to represent strings as numbers. Zero-mean and normalize data.



Bayesian probability analysis

Let us look at which piece of data about an individual gives us most information about the likelihood of survival, given our dataset D.

For some choice of $x = 0, 1$, $y = 0, 1$, we have by Bayes rule:

$$\text{Prob}(\text{survived} = x|\text{sex} = y, D) \propto \text{Prob}(\text{sex} = y|\text{survived} = x, D) \cdot \text{Prob}(\text{survived} = x|D) \tag{1}$$

We can calculate the prior (the probability estimate of survival prior to knowing the sex of the given person)

$$\text{Prob}(\text{survived} = x|D) = \frac{N_{\text{survived}=x}}{N_{\text{total passengers}}}, \tag{2}$$

and similarly the likelihood

$$\text{Prob}(\text{sex} = y|\text{survived} = x, D) = \frac{N_{\text{survived}=x,\text{sex}=y}}{N_{\text{total survivors}}} \tag{3}$$

with the normalization condition

$$\text{Prob}(\text{survived} = 0|\text{sex} = y, D) + \text{Prob}(\text{survived} = 1|\text{sex} = y, D) = 1. \tag{4}$$

$$\begin{aligned} p(A,B|D) &= p(A|B,D)p(B|D) \\ p(B,A|D) &= p(B|A,D)p(A|D) \end{aligned} \tag{5}$$

and

$$p(A,B|D) = p(B,A|D) \tag{6}$$

meaning

$$p(A|B,D) = \frac{p(B|A,D)p(A|D)}{p(B|D)} \tag{7}$$