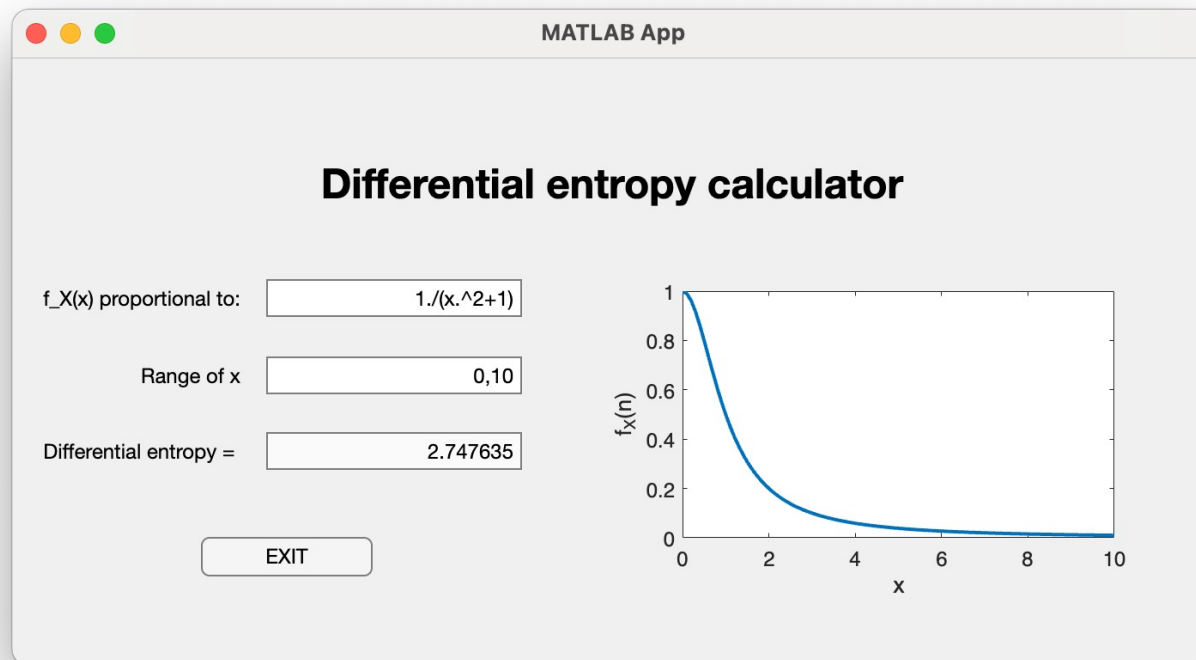# Information Theory for Data Science

Assignment 2 – Part B

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Problem 1

- Make a GUI for the evaluation of the differential entropy of a continuous RV

Problem 2

- Implement the Lloyd algorithm
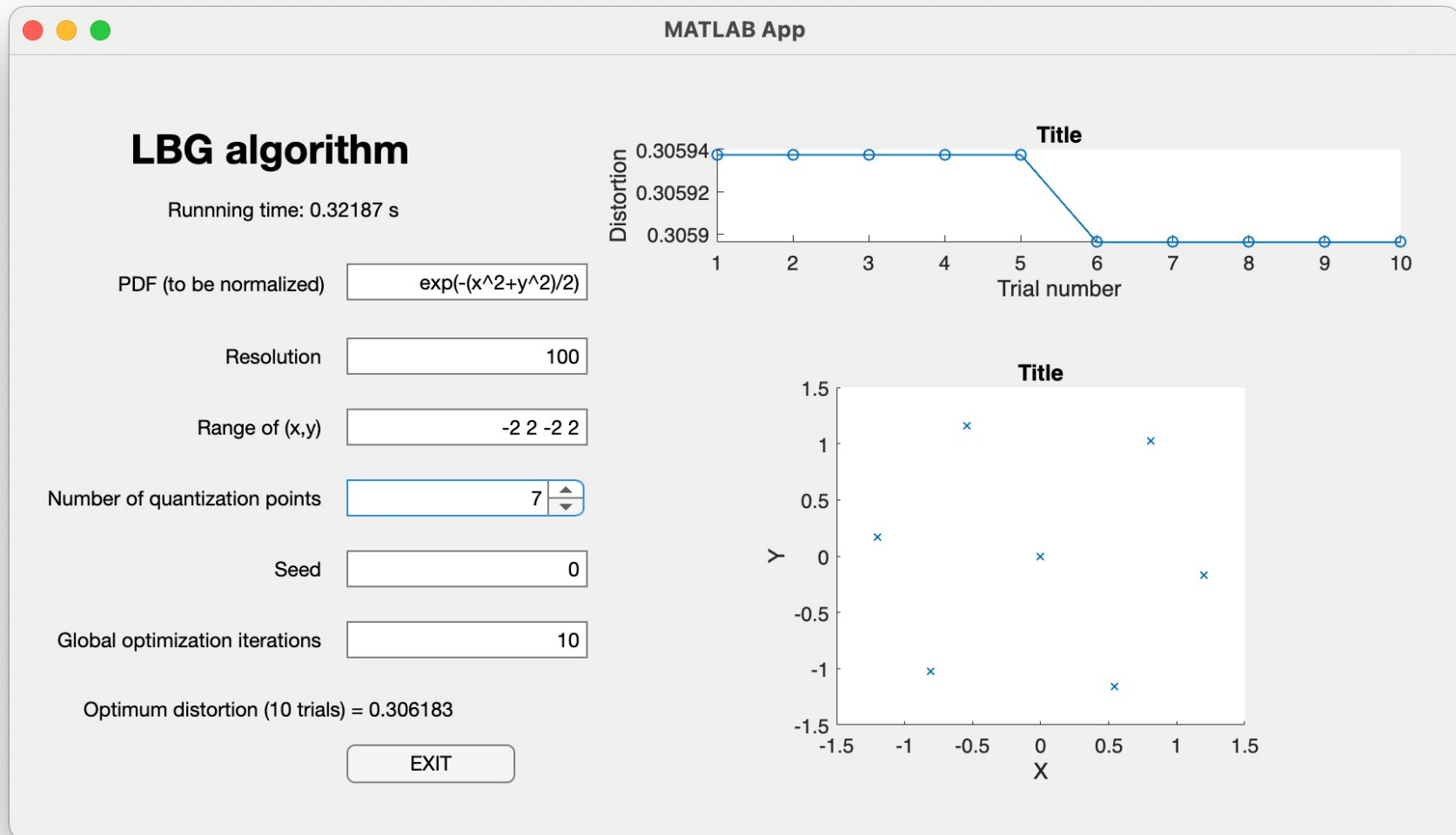
Problem 3

- Implement the LBG algorithm
  - Approximate the pdf by mass points on a square grid spanning a two-dimensional range with resolution N:

$$x_i = x_0 + \left(\frac{i}{N}\right)(x_N - x_0), y_j = y_0 + \left(\frac{j}{N}\right)(y_N - y_0), \qquad i, j \in \{0, \dots, N\}$$

  - Use several set of initial quantization points to approach global optimum
  - Plot minimum distortion vs trial number
  - Plot optimum quantization points after specified iterations

Problem 3

MATLAB App

LBG algorithm

Runnning time: 0.32187 s

PDF (to be normalized)   `exp(-(x^2+y^2)/2)`

Resolution   `100`

Range of (x,y)   `-2 2 -2 2`

Number of quantization points   `7`

Seed   `0`

Global optimization iterations   `10`

Optimum distortion (10 trials) = 0.306183

EXIT

Problem 4

- Calculate the differential entropy of the following pdfs:

  1. $f_X(x) = \dfrac{u(x-a) - u(x-b)}{b-a}$
  2. $f_X(x) = \lambda e^{-\lambda x} u(x)$
  3. $f_X(x) = \dfrac{1}{\Gamma(n)} x^{n-1} e^{-x} u(x)$