Probability Densities

1 Why

We want to talk about probability over infinite sets. We can not assign nonzero probability to each individual element of the set, since there are infinitely many it would never normalize.

2 Why

Instead, we assign probability to subsets of the set. In other words, we associate a measure with the set. The measure is normalized, meaning that the measure of the whole set, the event corresponding to any outcome occuring is 1.

A **probability density** or **probability density function** is a real-valued function from a set of outcomes which is non-negative and normalized. A real-valued function on a an infinite set is set is **normalized** if the sum over the its results is 1.