In this lecture, we provide a quick introduction into the conceptual framework of classical statistics. We use the words "classical" to make the distinction from the Bayesian framework that we have been using so far.

Recall that in the Bayesian framework, unknown quantities are viewed as random variables that have a certain prior distribution. In contrast, in the classical setting an unknown quantity is viewed as a non-random constant that just happens to be unknown.

We can still carry out estimation without assuming a prior for the unknown quantity. For example, if the unknown theta is the mean of a certain distribution, we can generate many samples from that distribution and form the sample mean. The weak law of large numbers then tells us that this estimate will approach in the limit as n increases the true value of theta.

After going through this argument, we will then take the occasion to introduce some terminology that is often used in connection with classical estimation methods. Now, the sample mean provides us a point estimate for the unknown theta, but does not tell us how accurate that estimate is.

To give a sense of the accuracy involved, we introduce the concept of a confidence interval, which is an interval that has high probability of containing the true theta.

In general, it is a common practice to report not just estimates, but also confidence intervals. But as we will discuss, one has to be careful in interpreting what exactly a confidence interval tells us.

We will see that we can easily calculate confidence intervals using the central limit theorem. And we will discuss in some detail some extra steps that need to be taken if we do not know the variance of the random variables involved.

We will then continue in the direction of greater generality. We will see that by repeated use of various sample means, we can also estimate more complicated quantities, such as, for example, the correlation coefficient between two random variables.

We will conclude by introducing a general estimation methodology, the so-called maximum likelihood estimation method. This is a method that applies always, even when the unknown parameter of interest cannot be interpreted as an expectation. It is a universally-applicable method. And fortunately, has some very desirable properties.