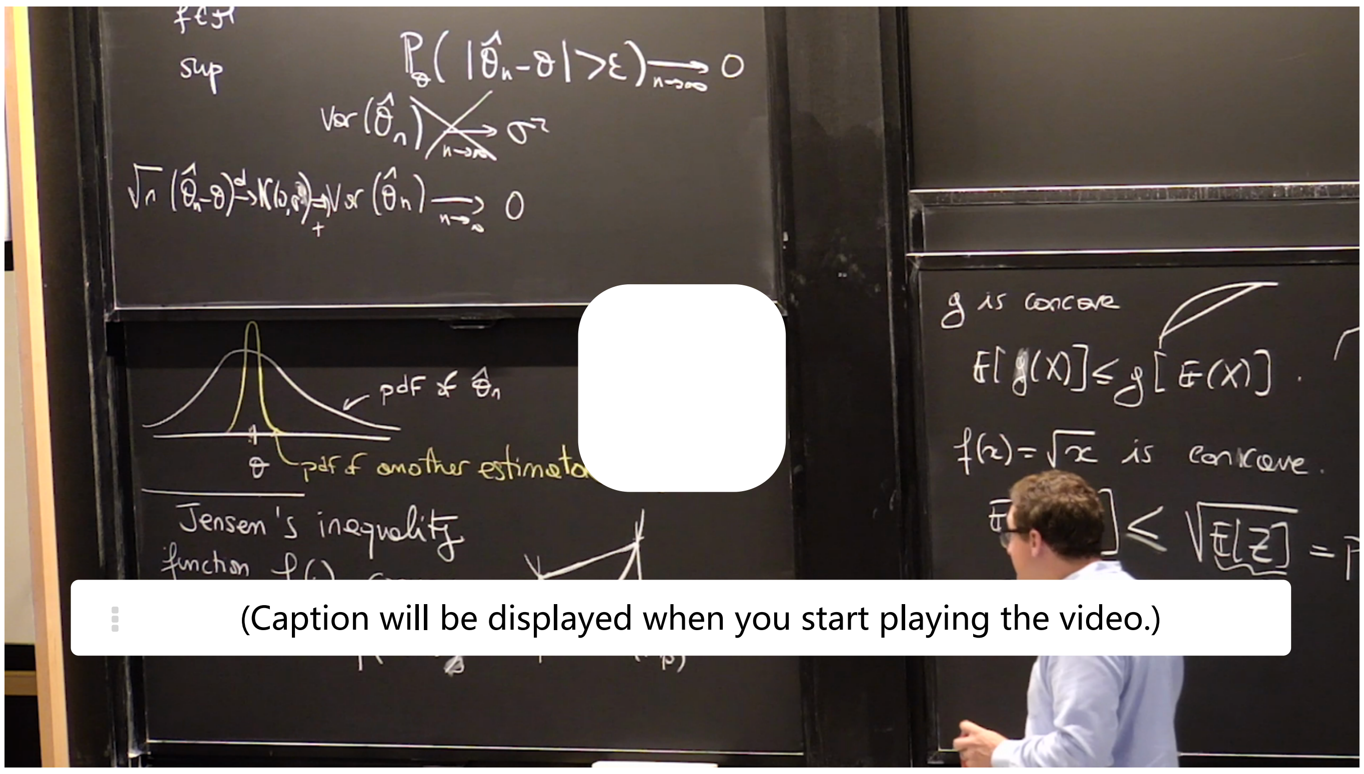
# 4. Variance of Estimators

## Variance of Estimators




when the xi's are IID Bernoulli p.
Variance of the average is 1/n times
the variance of each of them, right?
So this is p1 minus p divided by n.
Everybody remember this formula about variance of averages?
Can think of the variance of the sum, which
is the sum of the variance.
But since you multiply everything by 1/n,
you pick up a 1/n squared factor.
That's probably the most fundamental reason
why you would use averages in statistics,
the variance decays, linearly with the number of points
that you have here.
So now we're going to see a difference
between this guy and this guy because x1 is really
the average of just x1.

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## Variance of the Sample Mean

1/1 point (graded)

Again, let $X_1, \ldots, X_n \stackrel{iid}{\sim} \mathcal{U}([a, a+1])$ where $a$ is an unknown parameter. In terms of $n$, what is the variance of the estimator $\overline{X}_n$ ?

$\text{Var}\left[\overline{X}_n\right] =$ 1/(12*n) ✔ **Answer:** 1/(12*n)

$\frac{1}{12 \cdot n}$

**Solution:**

Since $X_1, \ldots, X_n$ are independent, the variance is additive. Hence,

$$\text{Var}\left(\overline{X}_n\right) = \frac{1}{n^2}\sum_{i=1}^{n}\text{Var}\left(X_i\right) = \frac{1}{n}\text{Var}\left(X_1\right)$$

Note that we used the fact that the $X_i$'s are identically distributed. Next,

$$\text{Var}\left(X_1\right) = \mathbb{E}\left[X_1^2\right] - \left(\mathbb{E}\left[X_1\right]\right)^2 = \int_a^{a+1} x^2\,dx - \left(a + \frac{1}{2}\right)^2 = a^2 + a + 1/3 - a^2 - a - 1/4 = 1/12.$$

Hence,

$$\mathrm{Var}\left(\overline{X}_n\right) = \frac{1}{n}\mathrm{Var}\left(X_1\right) = \frac{1}{12n}.$$

提交 你已经尝试了1次（总共可以尝试3次）

Answers are displayed within the problem

## 讨论

显示讨论

**主题：** Unit 2 Foundation of Inference:Lecture 4: Parametric Estimation and Confidence Intervals / 4. Variance of Estimators

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