WSABI Summer Research Lab **Summer 2025**

Lab 9: The Bootstrap

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9.1 Skittles Demo

You have an Skittles bag with n total Skittles and r red ones. Suppose the color of each Skittle is drawn independently from some distribution.

9.1.1 Your Task

1. Construct a 95% Wald and Agresti-Coull confidence interval for the **true** probability Mars, Inc. makes a Skittle red.
2. Use the bootstrap to construct a 95% confidence interval. Compare the width of the bootstrap interval to the Wald and Agresti-Coull intervals. What does this tell you about the relative coverage of the three intervals?

9.2 NBA Free Throws

Yesterday, you constructed 95% confidence intervals for the true free throw percentage of NBA players. You also performed a simulation study to see how well the Wald and Agresti-Coull intervals performed. Now, you will use the bootstrap to do the same.

9.2.1 Your Task

1. Use the bootstrap to construct a 95% confidence interval for the true free throw percentage of NBA players.
2. Overlay the bootstrap confidence interval on the plot you made in Task 8.2.1. Rank the three intervals in terms of width.
3. Use the bootstrap to construct a 95% confidence interval for the simulation study you performed in Task 8.2.2.
4. Add a plot of the coverage probability for the bootstrap confidence interval. How does it compare to the Wald and Agresti-Coull intervals?

We will be working with the bootstrap more in the Machine Learning unit.