Homework 1: Model Building and Model Selection/Fitting

Chun Hu

Deviant aggressive behavior

Theory I claim that there is a reinforcement system in deviant aggressive behavior. When a favorable outcome or reward occurs after a behavior, the behavior will be reinforced and become more likely to occur in the future. When an undesirable outcome or punishment occurs after a behavior, the behavior will be negatively reinforced and become less likely to occur in the future. If deviant aggressive behavior is reinforced, it is likely that the individuals received more rewards than punishments after performing these behaviors.

There are several solutions to reduce deviant aggressive behavior in this case. First, we can increase the punishment for deviant aggressive behavior. Possible ways include encouraging reports of deviant aggressive behavior to the police, increasing fine amount, increasing prison time, and etc. Second, we can reduce the reward for deviant aggressive behavior. Instead, we should increase the reward for alternative ways to deal with aggression. For example, social programs can teach alternative coping strategies that focus on emotion and behavior.

Theory II claim that deviant aggressive behavior is induced by frustration in personal life. Hence, individuals express their emotions toward authoritative figures, e.g. parents, bosses, or public officials. Since it is impossible to remove these authoritative figures from persona life, some other ways to reduce the aggressive behavior can be the following.

First, we can reduce the possibility of frustration in personal life by improving the social welfare system so that individuals can receive better social services. Second, we can increase mental health services that help people transition from frustrating and emotional periods to a more stable period. Third, we can establish social programs that encourage alternative coping strategies to deal with frustration in personal life, rather than towards authoritative figures

Theory III is built under the assumption that social rules systematically discriminate among people, that is, people are treated differently in the same situation. Thus, people who experience such discrimination are less likely to conform to social rules and more likely to display deviant aggressive behavior.

There are several ways to reduce deviant aggressive behavior in this case. First, we can reduce possible discrimination by reforming laws that benefit people differently. Introduce equal

education and working opportunities, and etc. Second, we can address the concerns of "oppressed" individuals and improve social rules accordingly.

Theory IV claim that people seek to find their social role and are socialized into the role that has a deviant subculture. Since school forms the mainstream culture, individuals attending school will be less likely to join a deviant subculture. Thus, we should promote more education opportunities and social events.

Several other ways to reduce deviant aggressive behavior include encouraging more positive subculture that could improve individuals' physical and mental health, suppressing deviant subculture by reforming laws and implementing punishments, and introducing social programs that help people, especially teenagers, to find the appropriate and positive social roles.

Waiting until the last minute

People often do things at the last minute (students turning in papers, professors grading exams, and so on).

a. According to temporal discounting, people tend to discount the value of rewards in the future. People often procrastinate when they will only receive the rewards in the future. Therefore, people often display a present bias when they choose to engage in activities that will give them reward in the short-term, instead of tasks that might give them better outcomes in the long term.
b. Theory I: Individuals discount the value of rewards in the future.
c. Theory II: Individuals discount the difficulty of the future task.
d. **Theory I** claim that people discount the value of long-term rewards and are in favor of short-term rewards.
    - Prediction I: If people perceive no reward in the present task, they will proceed to complete the future task. Even though they discount the value of the future task, the reward is more attractive than the present one.
    - Prediction II: People will not be able to accurately perceive the reward of the future task until deadline approaches. When deadline approaches, the reward becomes short-term reward and thus they will proceed with the task.

Theory II claim that people discount the difficulty of the future task and are confident that they can complete the task before the deadline.

- Prediction I: If people are warned about the difficulty of the future task, they will start to work on the task right away.
- Prediction II: People who are more confident in their ability to complete the task will procrastinate more than those who are less confident. People who are more confident will discount the difficulty of the future task more.

Selecting and Fitting a model

1. Indicate whether we would generally expect the performance of a flexible statistical learning model to be better or worse than an inflexible method.
   a. A flexible model will perform better. An inflexible model will likely capture all the variance in the large sample. With a small number of predictors, the inflexible model will become overfit. In addition, an inflexible model will assign biased weights to the predictors while a flexible model tends to reduce bias.
   b. The case is not desirable for both types of models, but an inflexible model will perform better. A flexible model can cause overfitting because of the small sample size. It will introduce more variance.
   c. The flexible model will perform better in finding the non-linear effect. Inflexible method might force an unwanted linearity on the data and lead to underfitting.
   d. An inflexible model will perform better. A flexible model will capture too much of the noise in the data and even increase variance.
2. Bias-variance: Think about the graph including bias, variance, training error, test error, and irreducible error curves, moving from less flexible statistical learning methods towards more flexible approaches
   - Training error: As flexibility increases, the model fits the observed data more closely. Thus, the training error declines monotonically as flexibility increases.
   - Test error: U-shaped. The test error initially declines as flexibility increases but at some points the decline stops and then it starts to increase again. This is because we are overfitting the data to get a small training error.

- Bias: The squared bias decreases as the model fits the observations more closely. It is correlated with the training error.
- Variance: Variance increases when we use more flexible models. Variance refers to the amount by which the model would change if we estimated it using a different training set. If a more flexible model fits the observations very closely, then small changes in the training data may cause the model to change considerable, thus resulting in more variance.
- Irreducible error: a constant because it does not change with the flexibility of the model. The parallel line lies below the test error because the expected test error will always be greater than the irreducible error.