

# Homework 1: Model Building and Model Selection/Fitting

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## Deviant aggressive behavior

### Theory I:

If this theory is correct, once a deviant aggressive behavior is negatively reinforced, it would be less likely for the subject to repeat such behavior, unless the subject perceives a higher reward. In this case, there would be a need for harsher punishment from laws and from the society. In addition to the establishment of harsh punishments, there would also be the need to ensure enforcement. If the harsh punishments are not enforced, there will be no effective negative reinforcement, which does not decrease the possibility that the subject still sees a higher reward in repeating such behavior.

### Theory II:

If this theory is correct, deviant aggressive behaviors are results of personal grievances shown in the form of hostility towards authoritative figures. Social policies can aim at facilitating venting environments in schools, companies or in social welfare agencies for families. In addition, adequate mental health care could be more widely included in health insurance. This will not only benefit the subordinate but also help the authoritative figures to not inflict undesirable dominance.

### Theory III:

If this theory is correct, deviant aggressive behaviors are product of discriminating social norms or rules. People with vested interest would not demonstrate deviant aggressive behaviors. In this case, social policies will have to aim at social justice and equality. The hows will be largely dependent on the subject matter, but a common general idea would be a more solid education built in the school systems to propel people to constantly think about the minorities.

### Theory IV:

This theory alienates deviant subculture, and to a certain degree believes that such culture would need to be shunned to prevent deviant aggressive behaviors from occurring. In this case, the theory would argue for a social policy that segregates the deviant subculture from the mainstream culture. For example, dividing students into classes with good behaviors and bad behaviors, or banning deviant aggressive students from coming to school at all. This theory would also push for no-bail policy to prevent convicts from re-entering the society and come into contact with the *good* people.

## Waiting until the last minute

a.

This observation might be true if people procrastinate to avoid facing failures and being in a state where they have the pressure to produce satisfactory outcomes, but no certainty or assurance that they could actually deliver. In this case, procrastination stems from the anticipation of social disapproval based on the performance people foresee for themselves. If the person does not start his/her work, there would be no work outcome to be judged. In other words, people procrastinate to postpone the failures they foresee being confirmed. This will be later referred as the fear-for-failure model.

An alternative explanation might be that people seek the thrill in beating or overcoming limited time resource. People do not believe in the economical tradeoff between time invested and the amount of reward. As a way to show that enjoying each moment is not less useful than carefully planning everything, they procrastinate to prove that they do not need as much time as one may think to complete the same amount of task. They would rather enjoy immediate pleasure. This will be later referred as the present-hedonistic model.

b.

Fear-for-failure model: the higher people think of themselves or the more desire to gain a certain level of social approval, and at the same time, the less confident they are for the tasks at hand, the longer they procrastinate.

c.

Present-hedonistic model: The less they see in the utility of finishing ahead, the more they procrastinate.

d.

Fear-for-failure model

- Prediction 1: With the same level of self-esteem (i.e. how they see themselves and how they want to be perceived), the easier the task is for the person, the less the he/she procrastinates, because there will be less risk for the potential failures to be confirmed.
- Prediction 2: With the same task difficulty level for the person, the less he/she is afraid of failure (i.e. does not have an obsession over how they see themselves or how they want to be perceived), no matter how hard the task is, they do not procrastinate because they do not fear seeing their own failures.

Present-hedonistic model

- Prediction 1: People who have had more rare, unexplainable, spontaneous events shaping their lives in the past will procrastinate more because they do not see the logical connection between time and outcome.

- Prediction 2: People who have greatly benefited from planning ahead in the past, or have gained satisfactory outcome with doing things ahead will not procrastinate as much because they see great utility in starting early.

## Selecting and fitting a model

1.

a. Given a large sample size, if the number of predictors is small, an inflexible learning method would be better because a flexible one is more likely to overfit. Since there is a limited number of predictors, and the flexible model would try to account for all the variance in the large sample, the predictors might be given exaggerated weights, i.e. the flexible model is too sensitive to the train data due to the limited predictors.

b. In this case, there are limited samples but many predictors, meaning little data in high dimension. Both might fail due to the small number of samples, but a flexible model may perform better at a higher dimension. However, if there is a strong prior assumption in the true relation, for example, it being a linear relation, an inflexible model may perform fine.

c. If the true relation is highly non-linear, the flexible model will perform better, because it can include more possible combinations of weights for the predictors.

d. If the variance of the error terms is high, this means that whatever model is being fitted does not capture the true relation. There could be too much restriction on the model. It would be better to explore with inflexible models or refer to the background knowledge for better assumptions.

2.

- Irreducible error: This curve, or lack thereof, reflects the discrepancy between the meta world and the real world. No matter how complex the model is, the error stays the same, meaning whatever predictors and complexity we have in the model, it just does not completely capture the true relation.
- Test error: In the underfitting zone, with increasing complexity, the model gets better at predicting the testing data. However, this curve concaves and the test error goes up with higher model complexity, because the model gets too good at describing the training data and cannot predict the new data.
- The bias squared and the training error: As the complexity of the model increases, it becomes better at describing and capturing the data set it has been fitted to. Because it is within the same data set, the bias squared and the training error will be on the decrease, but this by all means does not mean it is getting better as a model. See test error above.
- Variance: This curve would have the opposite behavior to bias squared and training error as model complexity goes up. When the complexity is small, variance is small because the model is not discriminating between different data points.