KDG Background Reading

- What are Polytopes?

  a geometric object with flat sides.

- Kernel Density Estimation (KDE)

  - a non-parametric way to estimate the PDF of a random variable.
  - Let $(x_1, x_2, \ldots, x_n)$ be i.i.d. sampled drawn from a known distribution f at a given point x. We are interested in estimating the shape of the function f.

$$\hat{f}_n(x) = \frac{1}{n} \sum_{i=1}^{n} K_h(x - x_i) = \frac{1}{nh} \sum_{i=1}^{n} K\left(\frac{x - x_i}{h}\right)$$

where $K_h \rightarrow$ Kernel (a non-negative f^n)

$h \rightarrow$ Bandwith (a smoothing parameter)

- Performance Metrics

  1. Expected Caliberation Error (ECE)

     Measures the expected difference between accuracy and confidence by grouping all samples (size N) in to K bins & calculating

$$ECE = \sum_{i=1}^{k} \frac{|B_i|}{N} |acc_i - conf_i|$$

acc_i and $conf_i$ are accuracy & average confidence in the i-th bin & $|B_i|$ is the number of samples in bin B_i

* The pseudo-probabilities are class probabilities we get from the final layer of a NN. The pseudo-probability of the predicted class generally over-estimates the actual probability of getting a correct answer.

* If this over-estimation can be measured, it can be used to caliberate the NN such that it's pseudo-probabilities would match the actual probability of the classes.

confidence

② Cohen's Kappa

$$\kappa = \frac{P_o - P_e}{1 - P_e}$$

$P_o \rightarrow$ relative observed agreement among raters
$P_e \rightarrow$ hypothetical probability of chance agreement.

* Measures the agreement between 2 raters who each classify N times into C mutually exclusive categories.

* It is a quantitative measure of reliability for 2 raters that are rating the same thing, corrected for how often that the raters may agree by chance.

rater 2

rater 1		correct	incorrect
	correct	A	B
	incorrect	C	D

In A & D, the two raters are in agreement.

$$P_o = P(\text{agreement}) = \frac{A+D}{A+B+C+D} = \frac{\#\,\text{agreements}}{\text{Total}}$$

Expected probability that both would say correct ⇒

$$P(\text{correct}) = \frac{A+B}{A+B+C+D} \times \frac{A+C}{A+B+C+D}$$

Expected probability that both would say incorrect ⇒

$$P(\text{incorrect}) = \frac{C+D}{A+B+C+D} \times \frac{B+D}{A+B+C+D}$$

Pe = overall random agreement probability that they agreed on either yes or no.

$$Pe = P(\text{correct}) + P(\text{incorrect})$$

Then $$K = \frac{Po - Pe}{1 - Pe}$$