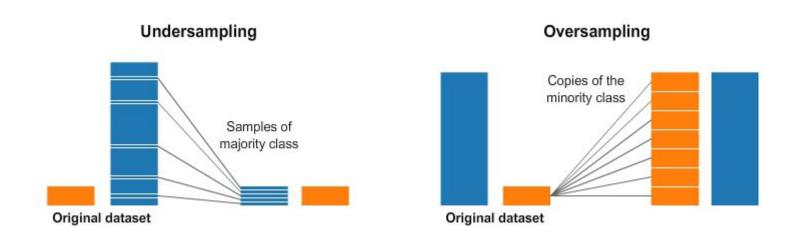


- We can handle the imbalanced dataset cases to minimize the Type II errors by balancing the class representations
- 2. To balance the classes we can
 - a. Decrease the frequency of the majority class
 - b. Increase the frequency of the minority class OR





- 3. Decreasing the frequency of majority class is done using random under sampling. For e.g.
 - a. Total observations 1000
 - b. Fraud 020
 - c. Non-fraud 980
 - d. Event rate of interest 2%
 - e. Take 10% of non-fraud cases randomly 98
 - f. Club with the fraud cases 118 sample size
 - g. Modified event rate 20 / 118 = 17%



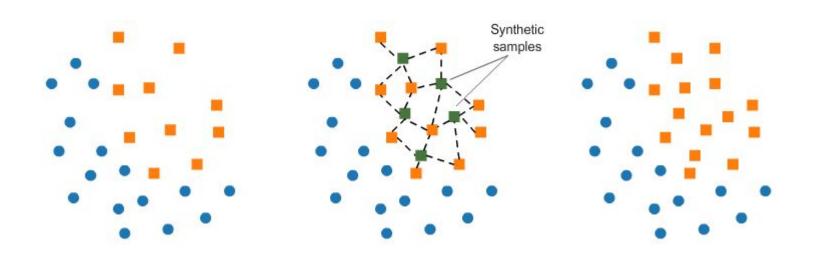
- Random oversampling is used to increase the frequency of minority class.
 This is done by replicating them in order to increase their representation. For e.g.
 - a. Total observations 1000
 - b. Fraud 020
 - c. Non-fraud 980
 - d. Event rate of interest 2%
 - e. Replicate a % of fraud cases n times e.g. 10 cases 20 times
 - f. Sample size changes from 1000 to 1200
 - g. Modified event rate 220/1200 = 18%
- 5. The simplest implementation of over-sampling is to duplicate random records from the minority class, which can cause overfitting.
- 6. In under-sampling, the simplest technique involves removing random records from the majority class, which can cause loss of information.



- Python imbalanced-learn module provides more sophisticated resampling techniques
- 2. For example, we can cluster the records of the majority class, and do the under-sampling by removing records from each cluster, thus seeking to preserve information.
- 3. In over-sampling, instead of creating exact copies of the minority class records, we can introduce small variations into those copies, creating more diverse synthetic samples.

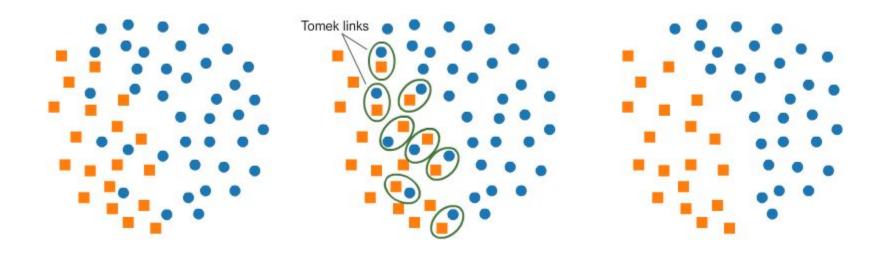


- 4. SMOTE (Synthetic Minority Oversampling TEchnique)
 - consists of synthesizing elements for the minority class, based on those that already exist.
 - b. It works randomly picking a point from the minority class and computing the k-nearest neighbors for this point.
 - c. Synthetic points are added between the chosen point and its neighbors.





- 5. Tomek links T-Link
 - a. Tomek links are pairs of very close instances, but of opposite classes.
 - b. Removing the instances of the majority class of each pair increases the space between the two classes, facilitating the classification process.





- 6. Cluster centroid based under sampling
 - a. Method that under samples the majority class by replacing a cluster of majority samples by the cluster centroid of a KMeans algorithm.
 - b. This algorithm keeps N majority samples by fitting the KMeans algorithm with N cluster to the majority class and using the coordinates of the N cluster centroids as the new majority samples.