Open Set Classification

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Introduction

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- ► However intelligent a machine is, it can only carry out a task in which it has been trained. It can rarely have some perception and behave logically in circumstances of which it is uninformed.

Classes

- ▶ Known or seen classes: The classes which are encountered in the training phase as well as the test phase.
- ▶ Unknown or unseen classes: The classes which appear in the test phase only.

The task of Open Set Classification

Let there be c known classes, namely, $1, 2, \ldots, c$.

► Correctly classify the instances belonging to the known classes to their rightful classes.

► Reject the instances as unknown if they come from some class other than those c classes.

Man and Machine

Figure: The child is picking up the correct toy in the left figure. In the right figure, when she encounters a situation like open set classification, she refuses to make a choice and returns a dazed look.

Solution: Principles of Reverse Nearest Neighborhood

- ▶ Nearest neighbor of **x**, NN(**x**): Finds the point which is nearest to the query point **x**. Similarly, we can have kNN(**x**).

- ▶ Reverse nearest neighbor of **x**, RNN(**x**): Finds the point/s which has/ have query point **x** as their nearest point. Similarly, we can have RkNN(**x**).

Task: Predicting class of a test instance **p**

Let there be c known classes, namely, 1, 2, . . . , c.

- ▶ Find the RkNN count of **p** w.r.t. c known classes individually.
- ▶ We also find the distance of nearest RkNN of **p** from each known class.
- ▶ We integrate the above two information to obtain the **p**'s membership scores for each known class.

Task: Predicting class of a test instance **p**

- ▶ If the RkNN count of **p** is 0 for all known classes, we classify or reject **p** as unknown.
- ▶ If not, we classify **p** to the class for which it gets the highest membership score.

Publication

P. Sadhukhan, "Can Reverse Nearest Neighbors Perceive Unknowns?," in IEEE Access, vol. 8, pp. 6316-6343, 2020, doi: 10.1109/ACCESS.2019.2963471

The End

Thank You!!