یادگیری ماشین

Bonus

Feating

حسین توکلیان

شماره دانشجویی

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خرداد 1399

دکتر ستار هاشمی

sat_image
h: 1, base clf : DecisionTreeClassifier(), Precision: 0.69, Recall: 0.39, F-Score: 0.50, AUC: 0.36, G-Mean: 0.62

dna
h: 1, base clf : DecisionTreeClassifier(), Precision: 0.89, Recall: 0.96, F-Score: 0.93, AUC: 0.39, G-Mean: 0.93

coding
h: 1, base clf : DecisionTreeClassifier(), Precision: 0.82, Recall: 0.74, F-Score: 0.78, AUC: 0.43, G-Mean: 0.86

dna
h: 2, base clf : DecisionTreeClassifier(), Precision: 0.88, Recall: 0.97, F-Score: 0.92, AUC: 0.34, G-Mean: 0.89

coding
h: 1, base clf : KNeighborsClassifier(), Precision: 0.85, Recall: 0.78, F-Score: 0.81, AUC: 0.38, G-Mean: 0.87

coding
h: 1, base clf : LinearSVC(), Precision: 0.63, Recall: 0.14, F-Score: 0.21, AUC: 0.28, G-Mean: 0.43

coding
h: 2, base clf : DecisionTreeClassifier(), Precision: 0.62, Recall: 0.47, F-Score: 0.48, AUC: 0.51, G-Mean: 0.57

sat_image
h: 1, base clf : KNeighborsClassifier(), Precision: 0.58, Recall: 0.47, F-Score: 0.52, AUC: 0.49, G-Mean: 0.67

sat_image
h: 1, base clf : KNeighborsClassifier(), Precision: 0.58, Recall: 0.47, F-Score: 0.52, AUC: 0.49, G-Mean: 0.67

What does “Feating is an aggregation of local models” mean?

A local model formed from instances similar to one we wish to classify will often be more accurate than a global model formed from all instances (Frank et al. 2003). However, in the general case we do not know the relevant distance metric so do not know what local neighbourhood to use. We propose to use many local distinct neighbourhoods, creating an ensemble by applying the base learner in each.

new ensemble approach, Feature-Subspace Aggregating (Feating), which builds local models instead of global models so it means Feating is a generic ensemble approach that can enhance the predictive performance of both stable and unstable learners.

Why is localization important for us in classification?

Our analysis shows that the new approach reduces the execution time to generate a model in an ensemble through an increased level of localisation in Feating. Our empirical evaluation shows that Feating performs significantly better than Boosting, Random Subspace and Bagging in terms of predictive accuracy, when a stable learner SVM is used as the base learner.

Our approach is guided by the principle that smaller problems, as a result of Feature-Subspace Aggregating, are easier to solve than a single global problem. It subdivides the feature-space into non-overlapping local regions in a single subdivision; and ensures that different subdivisions provide the distinct local neighbourhoods for each point in the feature- space. There are many ways a feature-space can be subdivided. Instead of using heuristics, we subdivide the feature-space exhaustively based on a user-specified number of features to control the level of localisation. The set of exhaustive feature-space subdivisions forms the basis to develop a new ensemble method which aggregates all local models or a random subset of the

How does Level Tree perform feature space division?

درخت از طریق محدود کردن فضا با جمع کردن نقاط با ویژگی ها یکسان در یک گره زیرفضاها رو ایجاد می کنه

Level Tree It is a restricted form of decision tree where each node at a single level of the tree must use the same attribute. A local model is trained from data in each leaf of the tree and it is attached to the leaf. To classify an example *x*, one first traverses the tree from the root to a leaf following the branches that *x* satisfies. Then the model at that leaf is applied to *x* to produce a classification. A Level Tree with local models is thus equivalent to a single global model, ready to predict when a test instance is presented.

Using Feature-Subspace Aggregating, the structures of all possible *h*-subdivision Level Trees (without local models) can be generated with minimal cost by enumeration since no attribute selection is required, unlike in the case of ordinary decision trees. Subdivision for numeric attributes will be considered in the

same manner as a cut-point selection in an ordinary decision tree using a heuristic such as information gain. As a result, though each attribute can appear at one level only in a Level Tree, the cut-points used for a numeric attribute on different nodes of the same level can be different.

The training data is filtered through the branches in the Level Tree as each node is created. If the training data is less than some minimum number (*nmin*) before a branch reaches the required level *h* or all instances belong to the same class, a leaf is formed; and the majority class of instances at the leaf is used for prediction. Otherwise, a local model is trained for each branch that has a level *h*.