How to deal with problem of small dataset in computer vision?

Introduction:

In this paragraph I want to explain the problem and reason of picking it. In our todays world we have much faster computers so we can easily run complex programs, train neural networks and other things on our personal computer/laptops. So all can do some researches but there is one problem in data science that we not always have good data sets available. So I have chosen as theme data augmentation as method to deal with small data set in computer vision field. For sure it is not the only way of improvement but still it could be very helpful.

Experiment and results:

So at the beginning I had data set with 7 classes in which we have: humans, cats, dogs, horses, bikes, flowers, cars. And there was not so a lot of them for such type of classification problem(there was from 202 images of cats,dogs,humans to 400 for bikes) so that was a problem for doing classification because when I was training my cnn without any augmentation it was overfitting( train accuracy: >97% test accuracy: ~ 50%) and that was probably bad, I could use less epochs and it wont been overfitting but it wont help with improving accuracy on test. So then I used light\_augmentation\_procesing.ipynb that was augmentating images a bit but with using a lot of methods for one picture, that makes not such a bit of sense but we can now that we create almost a new pictures. That gived a small improvement for 10% but I reduced number of epochs to 5 because I saw that such number as 20 is not necessary because it only overfits on train and doesn`t helps a lot on test. I had tested a lot of data augmentation methods, you can see them in file strong\_augmentation\_procesing.ipynb comment some of them that you think are unnecessary. In last experiment that showed result of > 99% accuracy on train and ~96% accuracy on test was used 8 methods such as noise, inversion, rotation and others that are not really different. But that cause one tiny problem, my cnn was training for 80 minutes that in huge project is good but in small research you want to see result much faster. I have viewed on the results and understood that I dogs looks like dogs or like flowers for my neural network. And it has an explanation. Reason is that images of dogs are behind the flowers, grass and so on.

Summary and conclusion:

Method of data augmentation is really useful for systems with small data or we our AI overfits. It is useful not only for image detection you can find another methods that will augment different type of data. It is really useful but can have a problem with it if using it not right. Like if you have dataset with 90% of class 1 element and 10% of class 2. Data augmentation wont help you(if talking about numeric data, in pictures it can make a good progress for you), and should be used another methods. And another thing that sometimes it is really not needed for you, In my example I could use bounding boxes that would improve good, and wont made dataset such complex. But I have understood it only after making this experiments, so all can be imporved.