Function Approximation with Fuzzy Operators

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Numerical analysis is the area of mathematics and computer science that creates, analyzes and implements algorithms for solving numerical problems of continuous mathematics. One of the main subfields of numerical analysis is interpolation. Interpolation is a method, where we determine a function (in most cases it is a polinom) which fits to the given data points and using this result we can determine the function value if new data points are given. In science in most cases we obtain samplings to determine the relations between inputs and outputs, which is called curve fitting, because usually we do not require the exact fit, only the approximation. We can say interpolation is a specific case of curve fitting, which case the function must go exactly through data points. There are lots of interpolations for example: linear, polynomial, spline and trignometric. Curve fitting can be done by minimizing the error function that measures the misfit between the function for any given value and the data points. One simple and widely used error function is the sum of the squares of the errors between the predictions for each data point and the corresponding target values, so that we minimize the energy function. The problems of the curve fitting and interpolation are that we do not understand the meaning of the parameters. In our approach we drop the traditional concept. We define effects as a basic units, which have meaning. In our system all function defined on [0,1] interval. In order to working in [0,1] interval we have to transform the real function to [0,1]. This can be done by using a linear function or using the Sigmoid function. Our new novel technique for function creation use Sigmoid function, Dombi operator, Conjunction operator and Aggregation operator [1],[2]. First we need natural effect, which is created by two Sigmoid functions, and the conjunction operator. We define positive effect, which means that this effect will increase the function value and we define negative effect, which is the opposite of the positive effect (ie. decrease the function value). The last step of function creation is to aggregate these effects. In function approximation we know the values. Our task is to divide real values into effects. We use global optimization for this problem. The critical point of the optimization is the initial values of the effects. If we define good initial points we have a high chance to find the global optimum. We develop a Java program to analyze our approach. In this system we can create any arbitrary funcion, and we can test the capabality of function approximation.

References

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