THE USE OF THIN PLATE SPLINES INTERPOLATION TO AUXILIARY IN THE GENERATION OF NEURAL CELLS

OSVALDO VARGAS JAQUES[1], REGINA CÉLIA COELHO[2]
[1]UNIGRAN – Universidade da Grande Dourados, Caixa Postal 515, 12201 Dourados, MS, Brasil
ojacques@dourados.br
[2]UNIMEP – Universidade Metodista de Piracicaba, Rodovia do açúcar, 5790, 87020-900 Piracicaba, SP, Brasil
rccoelho@unimep.br

Abstract This paper proposes a way to reduce the amount of data used for generation of neural cells with realistic morphologic characteristics. To solve this it is proposed the use of Thin Plate Splines Interpolation in the several measures extracted of neural cells. Each measure will have a function that describes it. This functions will be used to generate realistic morphologically neural cells.

1. Introduction

Studies present that the function of a neural cell is intimately related to the morphology of this cell. That is, the development of the animal is related to the complexity of morphologic neural cell. Thus, the creation of morphologic models would help in the understanding of the operation of several classes of cells. Because of this, in the generation of artificial neural cells it is important to take into account the features of natural cells.

A manner of generating artificial neurons is to use several distribution function related to the features extracted from natural cells. This can to produce a great amount of data. The proposal of this work is to use Thin Plate Splines (TPS) interpolation to reduce this amount of storage data related to morphometric features used to generate artificial neuron cells.

2. Materials and methods

To simulate the diameter of a neural segment in a level n it is necessary to know the diameter occurred in the previous segment (level n-1), because the diameter in the level n should not be larger than that of the level n-1 [1]. The Bayes rule allows this implementation because an event B is conditioned to the occurrence of an previous event A.

Each feature extracted of neural cells presents several levels (to a new bifurcation, a new level is created). Then, it is necessary to use Bayes rule to build distribution function (DF) of those features. Moreover, it is important to consider the relationship that can exist between the different features. Thus, taking into account the each neuron has several branching level, to each level we will have many different features (branching angles, branch length, diameter, length of a straight line segment, angles of straight line segment, etc.), the features in the level n have to be calculated considering the features of level (n-1), and the features can have some relationship between them (for instance, we have two different angles to control the bifurcation and they relate to each other) , we will have a large amount of data resulting of all these considerations, mainly if the distribution functions are generated using many bins. To solve this problem, we suggest the application of TPS as a reasonably general means to interpolate the distribution functions.

TPS are linear combinations of radial base functions which present a surface the which the deformation energy in relation to its load points is minimum [2]. In this way, those functions have a smooth and continuous curve which could be used for interpolation of functions presenting a non regular greed, characteristics of real cases of training as the DF generated from features of neural cells.

One of the advantages the use of TPS is the possibility to storage less data than using DF. We can build these functions with several bins to consider more accurate features and find the TPS corresponding to them. After than, it is possible to calculate a few points of TPS surface and to store just these data. Thus, we will have an amount of stored data much smaller than that of using DF. Furthermore, TPS can be used to interpolate n-dimensional functions. This is necessary to bind different features in the same function.

3. Conclusion

TPS proposed in this work are used to generate neural cells presenting shape similar to natural cells. These interpolation functions are included in stochastic graph grammar control for the development of the cells. Actually, we are considering just one level conditioned to the previous level, so the feature of level n is conditioned to the feature of level (n-1).

References

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