

This is a review text file submitted electronically to MR.

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Short title: What can Hamilton, Grassmann, Clifford and Hestenes tell us about perception and action systems.

MR Number: 2645344

Primary classification: 15A66

Secondary classification(s): 51N15, 68T40, 62M45, 68T45

Review text:

This paper is suitable for researchers with an interest in Clifford's geometric algebra applied to machine vision, pattern recognition, and statistical learning.

Sections 2 and 3 introduce Clifford's geometric algebra, as well as conformal geometric algebra. Here a modern textbook on the subject like *L. Dorst, D. Fontijne, S. Mann, Geometric Algebra for Computer Science: An Object-Oriented Approach to Geometry, The Morgan Kaufmann Series in Computer Graphics, San Francisco, 2007*, is to be recommended for better understanding of the basics and their application in the following sections. Especially for Section 3 the original paper by C. Perwass and G. Sommer on *The Inversion Camera Model* (in geometric algebra, including the catadioptric camera) [Proc. DAGM 2006, 28. Symposium für Mustererkennung, Berlin, Sept. 2006, K. Franke et al. (Eds.), Pattern Recognition, LNCS 4174, pp. 647-656, Springer-Verlag, Berlin, Heidelberg, 2006] should be consulted as well.

Section 4 *sketches* the structure of a Clifford (geometric algebra) support vector machine (SVM, for classification and regression) for which the reader will need to be well-familiar with the analysis of the real (and complex) analogues [see e.g. V.N. Vapnik, *Statistical Learning Theory*. Wiley, New York, (1998)], in order to correctly complete the sketch.

Section 5 outlines applications of (1) conformal geometric algebra invariants to object recognition with a catadioptric camera, of (2) conformal geometric algebra applied to robot gripping, and (3) function interpolation with a Clifford algebra valued SVM (CSVM). In the last application the results should be com-

pared with so-called quaternionic neural networks, which have shown excellent performance in interpolation and extrapolation tasks of 3D space curves [S. Buchholz, G. Sommer, *Quaternionic spinor MLP*, In 8th European Symposium on Artificial Neural Networks, ESANN 2000, Bruges, pp. 377-382, 2000.]