INCONSISTENT HOMOGENEOUS LINEAR INEQUALITIES

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If the set of linear inequalities

$$\sum_{j=1}^{N} a_{ij} x_j > 0, \qquad i = 1, 2, \cdots, M,$$

is consistent, there is an open convex polyhedral region of E^N , any point of which represents a solution vector x for the system. Iterative methods for finding a solution point have been given by Agmon [1] and Novikoff [2], among others.

If the set is inconsistent no such region exists. A generalization of the concept of solution is a collection of vectors $x^{(1)}, x^{(2)}, \cdots, x^{(2k+1)}$, or "committee," such that each inequality is satisfied by a majority of the members of the committee. This notion has application in pattern recognition [3].

The set of inequalities is contradictory if two of the inequalities represent half spaces separated by the same plane. A simple geometric argument shows that a committee solution exists for any noncontradictory set of homogeneous linear inequalities. The proof will be published elsewhere [4].

References

1. S. Agmon, The relaxation method for linear inequalities, Canad. J. Math. 6 (1954), 382-392.

2. A. B. J. Novikoff, On convergence proofs for perceptrons, Stanford Research Institute Report for Office of Naval Research Contract No. 3438(00), Stanford Research Institute, Menlo Park, Calif., January, 1963.

3. N. J. Nilsson, Learning machines, McGraw-Hill, New York, 1965.

4. C. M. Ablow and D. J. Kaylor, A committee solution of the pattern recognition problem, IEEE Trans. Information Theory, 1965.

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