Detecting Mental Retardation in Newborns and Infants: A Machine Learning Approach. Subramani Mani, MBBS, MS(Dept. of ICS, UCI) and Suzanne W. McDermott, Ph.D (Dept. of Family and Prev Med, Univ of South Carolina Sch of Med) and Michael J. Pazzani, Ph.D(Dept. of ICS, UCI). *Background*: The etiology of the majority of cases of mild Mental Retardation(MR) is not known. This is, in part, the result of delayed diagnosis since many of the signs of mild MR are subtle and are not identified during infancy. Thus, by the time a diagnosis is made, during early school years, the opportunity for a reliable history and physical examination is missed. However, the etiology of most MR is thought to be during the perinatal period and there is no reliable screening test at this stage to identify children at risk. *Methods*: Data from the Collaborative Perinatal Project of the National Institute of Neurological and Communicative Disorders and Stroke (NCPP) was used for our study. Twenty attributes comprising of demographic factors, antenatal, perinatal and early infancy findings thought to play a role in cognitive development were selected for our model. Data on 2137 mild or borderline MR and an approximately equal number of randomly selected normal children(2165) were available for this study. The Machine Learning(ML) algorithms used were Decision Tree Learners(C4.5 and CART), Rule Inducers (C4.5Rules and FOCL) and Naive Bayes(A robust classifier used as a baseline reference). Decision Trees and Rule Inducers of the form *If* ... *Then* are particularly important in a medical setting as they are expressive and the results can be used offline for decision support. The whole dataset was randomly split into fifty two-third(training) and one-third(testing) sets. The ML algorithms were trained on the training sets and tested with the unseen testing sets. We report the mean accuracy, sensitivity and specificity obtained with the test sets. *Result*: Table 1 gives a summary of the results. A significant child health problem particularly of an emotional

Table 1: Sensitivity and Specificity of the machine learning algorithms (MR $n = 2137$, Normal $n = 2165$)

%	C4.5	C4.5Rules	Naive Bayes	CART*	FOCL†
Accuracy	68.5	68.9	70.3	69.6	68.4
Sensitivity	68.7	69.6	75.1	–	72.1
Specificity	68.3	68.2	65.5	–	64.8

* Only total accuracy scores available † Results from 20 runs

nature or a combination of physical and emotional problems consistently figured in the top of the decision tree as a risk factor for mild MR in more than 80% of the runs. The other attributes which were consistently significant as risk factors were low maternal education level(high school or less) and maternal race (non-white). Conclusion: A machine learning approach holds promise as a screening tool during the newborn and infancy period to identify children at risk of MR. Early detection is important in designing intervention strategies which might contribute significantly to the quality of life of children at risk, lightening the burden on care givers and society as a whole.