

CS294-082: Experimental Design for Machine Learning on Multimedia Data  
Fall 2020

Homework 2

To be discussed: October 2nd, 2020

1) Tables

- a) How many states can  $n$  boolean variables assume?
- b) How many functions can be built from  $n$  boolean variables to a binary label?
- c) How many functions can be built from  $n$  boolean variables to a  $k$ -class labeling?
- d) Assume an arbitrary table with  $m$  columns and  $n$  rows. How many different binary labelings can be created for that table?
- e) Assume a table with  $m$  columns and  $n$  rows, each cell has an information content of  $q$  bits. How many different tables are there?

2) Discuss: Why is it problematic to assume the existence of real numbers in a machine learner?

3) Draw the smallest (arrow and circle) finite state machine for the following functions.

- a) Two boolean variable NOR.
- b) Three boolean variable equality.
- c) Two boolean variable AND or two boolean variable OR depending on an input parameter.

4) Partitioning

- a) How many subsets can be created from a set of  $n$  elements?
- b) Explain how creating subsets is the same as binary labeling.
- c) Assume you have  $n$   $m$ -dimensional points in a coordinate system. How many binary labelings can you generate for these points?
- d) How many  $k$ -class labelings can you generate for the points in c)?