***Machine Learning Yearning***

***1. Why Machine Learning Strategy***

* Machine learning is the foundation of countless important applications.
* This book will help my team make rapid progress
* If your ML model’s accuracy sucks you can try many things such as:
  + Collecting more data
  + Diversifying data
  + Hyperparameter tuning (more layers, hidden units, parameters, network size)
* If you choose well among the possible options you will do good if not you waste a lot of time
* ML problems leave clues in what’s useful to try… Learning to read these clues will save you months or years in development time

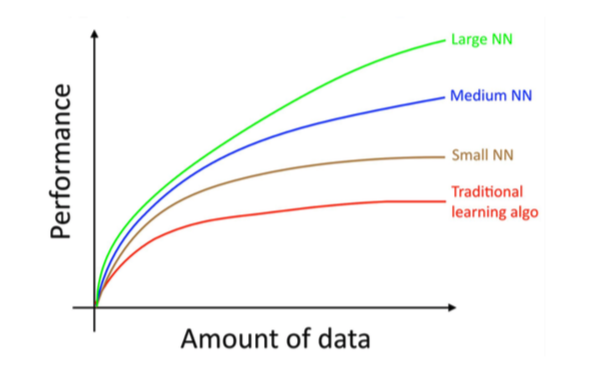
***2. How to use this book to help your team***

* After this book I will have a deep understanding of the technical direction for a machine learning project
* A few changes in prioritization can have a huge effect on your team’s productivity

***3. Prerequisites and Notation***

* Supervised learning: Learning functions that map from x to y using labeled training examples of (x,y)

***4. Scale drives machine learning progress***

* Two of the biggest drivers of recent progress:
  + Data availability: People are spending so much time on digital devices in this era. Their digital activities generate huge amounts of data that we can feed to our AI.
  + Computational scale: Since only a few years ago we now have the ability to train neural networks that are big enough to take advantage of the huge datasets we now have
* To get the best performance these days, the process is still:
  + Train a bigger network (the plateaue is higher)
  + Get more data

***5. Your development and test sets***

* Usually define 3 test sets:
  + **Training set**: Which you run your learning algorithm on
  + **Dev (development) set**: Which you use to tune your parameters, select features, and make other decisions regarding the learning algorithm
  + **Test set**: Which we use to evaluate the performance of the algorithm, but not make any decisions regarding what learning algorithm or parameters to use
* The purpose of the dev and test sets are to direct your team toward the most important changes to make to the machine learning system
* Make sure to choose dev and test sets to reflect data you expect to get in the future

***6. Your dev and test sets should come from the same distribution***

* + There is a chance that your team will build something that works well on the dev set, only to find out it does poorly on the test set. That means make sure your Dev and Test sets are picked out of the same hat of data. And this hat should contain data that we expect to see in production
  + Ex) Suppose we have a system that works well on the dev set but not the test set. If the dev and test sets came from the same distribution, then we know you overfit the dev set (so get more data). But if the dev and test sets came from different distributions. There can be several issues:
    - You had overfit to the Dev-set
    - The test set is harder than the dev set. So you algorithm might be doing as well as it could but it’s just not strong enough
    - The test set is not harder.. its just different from the dev set. What worked on the dev set doesn’t work on your test set because it is so different (ex. Different angles, resolutions). In this case we wasted effort improving the dev set performance.
  + Having mismatched dev and test sets introduces uncertainty for no reason
  + Having mismatched dev and test sets make it harder to figure out what working and what isn’t

***7. How large do the dev/test sets need to be ?***

* + The dev set should be large enough to detect the differences between the algorithms that you are trying out.
    - ex) if classifier A has an accuracy of 90.0% and classifier B has an accuracy of 90.1% then a dev set of 100 examples would not be able to detect this 0.1% difference
  + Dev sets with sizes 1,000 to 10,000 are common
  + Test set should be large enough to give high confidence in the overall performance of the system. (People say 30% of your data)
  + There is also no need to have excessively large dev/test sets beyond what is needed to evaluate the performance of your algorithm