* ~~수업에 사용하는 코드~~[~~https://github.com/hunkim/DeepLearningZeroToAll~~](https://github.com/hunkim/DeepLearningZeroToAll)
* ~~수업의 개요~~[~~비디오 [http://hunkim.github.io/ml/video.png](https://www.youtube.com/watch?v=BS6O0zOGX4E)~~](https://www.youtube.com/watch?v=BS6O0zOGX4E)[~~슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec0.pdf)~~](http://hunkim.github.io/ml/lec0.pdf)
* ~~머신러닝의 개념과 용어~~[~~비디오 [http://hunkim.github.io/ml/video.png](https://www.youtube.com/watch?v=qPMeuL2LIqY)~~](https://www.youtube.com/watch?v=qPMeuL2LIqY)~~(TensorFlow의 기본~~[~~Lab 비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/-57Ne86Ia8w)~~](https://youtu.be/-57Ne86Ia8w)~~)~~[~~강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec1.pdf)~~](http://hunkim.github.io/ml/lec1.pdf)[~~Lab 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/137IlT2N3AYcclqxNuc8j9RDrIeHiYkSZ5JPg_vg9Jqk/edit#slide=id.g1d115b0ec5_0_215)~~](https://docs.google.com/presentation/d/137IlT2N3AYcclqxNuc8j9RDrIeHiYkSZ5JPg_vg9Jqk/edit#slide=id.g1d115b0ec5_0_215)
* ~~Linear Regression 의 개념~~[~~비디오 [http://hunkim.github.io/ml/video.png](https://www.youtube.com/watch?v=Hax03rCn3UI)~~](https://www.youtube.com/watch?v=Hax03rCn3UI)~~(TensorFlow 로 구현~~[~~Lab 비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/mQGwjrStQgg)~~](https://youtu.be/mQGwjrStQgg)~~)~~[~~강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec2.pdf)~~](http://hunkim.github.io/ml/lec2.pdf)[~~Lab 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/12raZrY3d244q6jGuC7EykeSPzjP1-FqofMiNlx5Q52o)~~](https://docs.google.com/presentation/d/12raZrY3d244q6jGuC7EykeSPzjP1-FqofMiNlx5Q52o)
* ~~Linear Regression cost함수 최소화~~[~~비디오 [http://hunkim.github.io/ml/video.png](https://www.youtube.com/watch?v=TxIVr-nk1so)~~](https://www.youtube.com/watch?v=TxIVr-nk1so)~~(TensorFlow 로 구현~~[~~Lab 비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/Y0EF9VqRuEA)~~](https://youtu.be/Y0EF9VqRuEA)~~)~~[~~강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec3.pdf)~~](http://hunkim.github.io/ml/lec3.pdf)[~~Lab 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1Az_ulisKyBH7hVNrQmN_3HyrX1sAxUMqXQvvtaRGYl4)~~](https://docs.google.com/presentation/d/1Az_ulisKyBH7hVNrQmN_3HyrX1sAxUMqXQvvtaRGYl4)
* ~~여러개의 입력(feature)의 Linear Regression~~[~~비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/kPxpJY6fRkY)~~](https://youtu.be/kPxpJY6fRkY)~~(TensorFlow 로 구현~~[~~Lab1 비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/fZUV3xjoZSM)~~](https://youtu.be/fZUV3xjoZSM)~~) (파일 데이타 로딩~~[~~Lab2 비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/o2q4QNnoShY)~~](https://youtu.be/o2q4QNnoShY)~~)~~[~~강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1bHVxjCVvRKjCgtf6OMmxe35nR65LnsERoWSefWscv2I/)~~](https://docs.google.com/presentation/d/1bHVxjCVvRKjCgtf6OMmxe35nR65LnsERoWSefWscv2I/)[~~Lab 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1WF5yphSXyzYLG8wmVvOpRmgAlw4vewbK51ZwLAOFZXk)~~](https://docs.google.com/presentation/d/1WF5yphSXyzYLG8wmVvOpRmgAlw4vewbK51ZwLAOFZXk)
* ~~Logistic (Regression) Classification~~[~~강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec5.pdf)~~](http://hunkim.github.io/ml/lec5.pdf)[~~실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/180ZISPNRVWYKyV61xoZepZ_KVUK6mujIXuwXE0eKZuM)~~](https://docs.google.com/presentation/d/180ZISPNRVWYKyV61xoZepZ_KVUK6mujIXuwXE0eKZuM)
  + ~~Hypothesis 함수 소개~~[~~비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/PIjno6paszY)~~](https://youtu.be/PIjno6paszY)
  + ~~Cost 함수 소개~~[~~비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/6vzchGYEJBc)~~](https://youtu.be/6vzchGYEJBc)
  + ~~TensorFlow 에서의 구현~~[~~비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/2FeWGgnyLSw)~~](https://youtu.be/2FeWGgnyLSw)
* Softmax Regression (Multinomial Logistic Regression) [슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec6.pdf)](http://hunkim.github.io/ml/lec6.pdf) [실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1FPcmOh_gmBw7uyOThFyKwdx7Ua2q8tX0kVFOSwI6kas)](https://docs.google.com/presentation/d/1FPcmOh_gmBw7uyOThFyKwdx7Ua2q8tX0kVFOSwI6kas)
  + Multinomial 개념 소개 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/MFAnsx1y9ZI)](https://youtu.be/MFAnsx1y9ZI)
  + Cost 함수 소개 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/jMU9G5WEtBc)](https://youtu.be/jMU9G5WEtBc)
  + Lab1: TensorFlow에서의 구현 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/VRnubDzIy3A)](https://youtu.be/VRnubDzIy3A)
  + Lab2: TensorFlow에서의 Fancy한 구현 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/E-io76NlsqA)](https://youtu.be/E-io76NlsqA)
* ML의 실용과 몇가지 팁 [강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec7.pdf)](http://hunkim.github.io/ml/lec7.pdf) [실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1cVwqMpERToATs1JGYps0F3MLARP8OAlw6ZIe-lpPHYs)](https://docs.google.com/presentation/d/1cVwqMpERToATs1JGYps0F3MLARP8OAlw6ZIe-lpPHYs)
  + 학습 rate, Overfitting, 그리고 일반화 (Regularization) [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/1jPjVoDV_uo)](https://youtu.be/1jPjVoDV_uo)
  + Training/Testing 데이타 셋 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/KVv1nMSlPzY)](https://youtu.be/KVv1nMSlPzY)
  + Lab 1: TensorFlow에서의 구현 (학습 rate, training/test 셋으로 성능평가) [실습 비디오 1[http://hunkim.github.io/ml/video.png](https://youtu.be/oSJfejG2C3w)](https://youtu.be/oSJfejG2C3w)
  + Lab 2: Meet MNIST dataset [실습 비디오 2 [http://hunkim.github.io/ml/video.png](https://youtu.be/ktd5yrki_KA)](https://youtu.be/ktd5yrki_KA)
* 딥러닝의 기본 개념과, 문제, 그리고 해결 [강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec8.pdf)](http://hunkim.github.io/ml/lec8.pdf) [실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1gQ7Xxrhylkr5Kk5pG15yvX3yOln_hk2-H6jrQeXqKmU)](https://docs.google.com/presentation/d/1gQ7Xxrhylkr5Kk5pG15yvX3yOln_hk2-H6jrQeXqKmU)
  + 딥러닝의 기본 개념: 시작과 XOR 문제 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/n7DNueHGkqE)](https://youtu.be/n7DNueHGkqE)
  + 딥러닝의 기본 개념2: Back-propagation 과 2006/2007 '딥'의 출현 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/AByVbUX1PUI)](https://youtu.be/AByVbUX1PUI)
  + Lab : Tensor Manipulation [실습 비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/ZYX0FaqUeN4)](https://youtu.be/ZYX0FaqUeN4)
* Neural Network 1: XOR 문제와 학습방법, Backpropagation (1986 breakthrough) [강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec9.pdf)](http://hunkim.github.io/ml/lec9.pdf)[실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1KHpjyziDm0Wle-OI-6TZhWM2Oj7YiypXuZOZ1SJW8ds/edit?usp=drive_web)](https://docs.google.com/presentation/d/1KHpjyziDm0Wle-OI-6TZhWM2Oj7YiypXuZOZ1SJW8ds/edit?usp=drive_web)
  + XOR 문제 딥러닝으로 풀기 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/GYecDQQwTdI)](https://youtu.be/GYecDQQwTdI)
  + 특별편: 10분안에 미분 정리하기 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/oZyvmtqLmLo)](https://youtu.be/oZyvmtqLmLo)
  + 딥넷트웍 학습 시키기 (backpropagation) [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/573EZkzfnZ0)](https://youtu.be/573EZkzfnZ0)
  + 실습1: XOR을 위한 텐스플로우 딥넷트웍 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/oFGHOsAYiz0)](https://youtu.be/oFGHOsAYiz0)
  + 실습2: Tensor Board로 딥네트웍 들여다보기 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/lmrWZPFYjHM)](https://youtu.be/lmrWZPFYjHM)
* Neural Network 2: ReLU and 초기값 정하기 (2006/2007 breakthrough) [강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec10.pdf)](http://hunkim.github.io/ml/lec10.pdf) [실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1fuOqBNMLgUskKUzpEEDVPXrsByEGBpXW-zpHxyl-haY)](https://docs.google.com/presentation/d/1fuOqBNMLgUskKUzpEEDVPXrsByEGBpXW-zpHxyl-haY)
  + XSigmoid 보다 ReLU가 더 좋아 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/cKtg_fpw88c)](https://youtu.be/cKtg_fpw88c)
  + Weight 초기화 잘해보자 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/4rC0sWrp3Uw)](https://youtu.be/4rC0sWrp3Uw)
  + Dropout 과 앙상블 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/wTxMsp22llc)](https://youtu.be/wTxMsp22llc)
  + 레고처럼 넷트웍 모듈을 마음껏 쌓아 보자 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/YHsbHjTBx9Q)](https://youtu.be/YHsbHjTBx9Q)
  + 실습: 딥러닝으로 MNIST 98%이상 해보기 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/6CCXyfvubvY)](https://youtu.be/6CCXyfvubvY)
* Convolutional Neural Networks [강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec11.pdf)](http://hunkim.github.io/ml/lec11.pdf) [실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1h90rpyWiVlwkuCtMgTLfAVKIiqJrFunnKR7dqPNtI6I/edit)](https://docs.google.com/presentation/d/1h90rpyWiVlwkuCtMgTLfAVKIiqJrFunnKR7dqPNtI6I/edit)
  + ConvNet의 Conv 레이어 만들기 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/Em63mknbtWo)](https://youtu.be/Em63mknbtWo)
  + ConvNet Max pooling 과 Full Network [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/2-75C-yZaoA)](https://youtu.be/2-75C-yZaoA)
  + ConvNet의 활용예 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/KbNbWTnlYXs)](https://youtu.be/KbNbWTnlYXs)
  + 실습1: TensorFlow CNN 의 기본 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/E9Xh_fc9KnQ)](https://youtu.be/E9Xh_fc9KnQ)
  + 실습2: TensorFlow로 구현하자 (MNIST 99%) [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/pQ9Y9ZagZBk)](https://youtu.be/pQ9Y9ZagZBk)
  + 실습3: Class, tf.layers, Ensemble (MNIST 99.5%) [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/c62uTWdhhMw)](https://youtu.be/c62uTWdhhMw)
* Recurrent Neural Network [강의 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lec12.pdf)](http://hunkim.github.io/ml/lec12.pdf) [실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://docs.google.com/presentation/d/1UpZVnOvouIbXd0MAFBltSra5rRpsiJ-UyBUKGCrfYoo/edit)](https://docs.google.com/presentation/d/1UpZVnOvouIbXd0MAFBltSra5rRpsiJ-UyBUKGCrfYoo/edit)
  + NN의 꽃 RNN 이야기 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/-SHPG_KMUkQ)](https://youtu.be/-SHPG_KMUkQ)
  + 실습1: RNN의 기본 [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/B5GtZuUvujQ)](https://youtu.be/B5GtZuUvujQ)
  + 실습2: Hi Hello RNN Traning [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/39_P23TqUnw)](https://youtu.be/39_P23TqUnw)
  + 실습3: Long Sequence RNN [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/2R6nfCNNz1U)](https://youtu.be/2R6nfCNNz1U)
  + 실습4: Stacked RNN + Softmax Layer [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/vwjt1ZE5-K4)](https://youtu.be/vwjt1ZE5-K4)
  + 실습5: Dynamic RNN [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/aArdoSpdMEc)](https://youtu.be/aArdoSpdMEc)
  + 실습6: 타임시리즈 RNN [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/odMGK7pwTqY)](https://youtu.be/odMGK7pwTqY)

 [보너스] Deep Deep Network AWS 에서 GPU와 돌려보기 (powered by AWS) [실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lab13.pdf)](http://hunkim.github.io/ml/lab13.pdf) [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/9VckXVoJEe0)](https://youtu.be/9VckXVoJEe0)

 [보너스2] AWS에서 저렴하게 Spot Instance를 터미네이션 걱정없이 사용하기 (powered by AWS) [실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](http://hunkim.github.io/ml/lab14-aws_spot_instance.pdf)](http://hunkim.github.io/ml/lab14-aws_spot_instance.pdf) [비디오 [http://hunkim.github.io/ml/video.png](https://youtu.be/orIXr5xd6P0)](https://youtu.be/orIXr5xd6P0)

 [보너스3] Google Cloud ML을 이용해 TensorFlow 실행하기 [실습 슬라이드 [http://hunkim.github.io/ml/pdf.png](https://github.com/hunkim/GoogleCloudMLExamples/blob/master/Google%20Cloud%20ML.pdf)](https://github.com/hunkim/GoogleCloudMLExamples/blob/master/Google%20Cloud%20ML.pdf) [비디오 (한글) [http://hunkim.github.io/ml/video.png](https://youtu.be/8Jkz2HexDAM)](https://youtu.be/8Jkz2HexDAM) [비디오 (영어) [http://hunkim.github.io/ml/video.png](https://youtu.be/EIRD3HAp-QQ)](https://youtu.be/EIRD3HAp-QQ)