**总结报告7**

**（国庆）**

**一、学习内容：机器学习中的数学：多元微积分WEEK5,WEEK6；**

**机器学习中的数学：PCA WEEK1,WEEK2,WEEK3；**

**Multivariate Calculus: WEEK 5**

1. **Newton-Raphson method**

**①，**by using this, we don’t need to graph and visualize it everywhere.

②非线性方程逐次线性化 （零点root finding）

Remark: Sometimes things can go wrong:，that can get big when  is very small.( at turning points of ,.the step size =)

1. **Gradient Descent:** 
   1. Grad :Grad points up the steepest descent
   2. Directional gradient: 
   3. 
2. **Constrained Optimisation method of Lagrange Multipliers**

即拉格朗日乘数法，具体方法此处省略。

**Multivariate Calculus: WEEK 6**

1. **simple linear regression**

** **

A measure of how good the fit is:

令

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1. **General non-linear Least squares method**

**对于，**





由



得



**Notice:** cur=current; cst=constant.

**Remark:**provides us with **an indication of the fitting parameter**, but not the uncertainty related to the particular measurable variables. The uncertainty is determined through the parameter.

**PCA:WEEK 1**

**1、PCA：principal component analysis**

a way to reduce dimensionality of data using orthogonal projections

**2、Statistical properties**

**①Mean Values: the average data point/expected value**

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**②Variance: the spread of the data around the mean value**

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**③Covariances:**

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**Covariance Matirx:**

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**Symmetric，positive definite matrix（对称正定阵）**

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 covariance matrix



1. **Linear transformation of means**
2. **Affine(仿射变换)**

**PCA:WEEK 2**

**1、Inner products:** It is often necessary to measure **similarity** between data point.

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**2、Dot products: special cases of inner product of two vectors**

**①length:**

**②distance**

1. **angle：cos<x,y>=**

**3、Inner products: is defined as a symmetric, positive definite, bilinear mapping**

**（对称，正定，双线性映射）**

* 1. **Definition：**



·symmetric:

·positive definite:

·bilinear：



**Notice：**bilinear means linearity in both arguments of the function

* 1. **Length：** the norm（范数）

Remark：The norm(inner product) has some nice properties:



* 1. **Distances:**

(If dot product, it is Euclidean distance)

* 1. **Angles：**



The angle between two vectors tells us how similar their orientations are.

* 1. **Orthogonality:**

Means the most dissimilar and nothing in common besides the origin.

1. **Inner product of functions and random variables**
   1. **Functions:**

** ** orthogonal

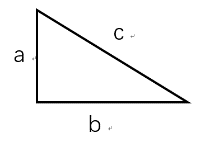
* 1. **Random Variables:**

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If define inner product，

Then 

（类似勾股定理）







**5、K Nearest Neighbors Algorithm**

**PCA:WEEK 3**

1. **One-dimensional Subspaces**

**Properties：**

1. ****
2. ****

**Then，**



**Remark:**is called Projection Matrix



1. **Projection onto general subspaces:**
   1. 
   2. 





i.

ii. 



**Remark:**is called Projection Matrix,

in the special case of an orthonormal basis, .