

# Thesis Outline

Cecil Li



Revision	Time	Made by	Comments
1	30 Jan 2014	Cecil Li	Drafted revision 1 from meeting notes.
2	4 Feb 2014	Cecil Li	Added drawing 1 Preprocessing and Analysis Design
3	18 Feb 2014	Cecil Li	Modified drawing 1 to adjust the change in experiment design. Added Table 1 for keeping track of work.
4	25 Feb 2014	Cecil Li	Added Section 5.1 Analysis
5	19 Mar 2014	Cecil Li	Completed Chapter 2: WB

## **1 INTRODUCTION**

- State the problem of water availability in agriculture, from literature review. Paraphrase and elaborate.
- Introduce the structure of this thesis, explain what are the individual sections.

## **2 STUDY OF WATER BALANCE MODEL**

- Other people's work on Water balance model
- Explain the water balance model and where is it used
- Limitations of this model
- Briefly introduce the datasets being used, due to the need to spatial data

## **3 DATA INTEGRATION**

- Explain the datasets: SILO, AWAP, MODIS, DED, LandSAT, etc.
  - What are them?
  - How to access?
  - Preprocessing data(reprojection, normalization etc.)
- Integrate multiple datasets: the i-EKbase system
- 2 data representation
  - Point-based
  - Spatial data representation
  - Talk about the temporal resolution and the spatial resolution

## **4 MOBILE APP DECISION SUPPORT SYSTEM**

- Point-based analysis, its purpose and application
- Diagrams, the flow, components
- Machine learning approach
- Visualisation

## **5 AREA-WISE ANALYSIS**

- Introducing DED and how it improves the spatial resolution
- Methods of integrating multiple datasets with DED, interpolation or/and ML technique to improve resolution
- Analytics with various ML algorithm, experiments and results

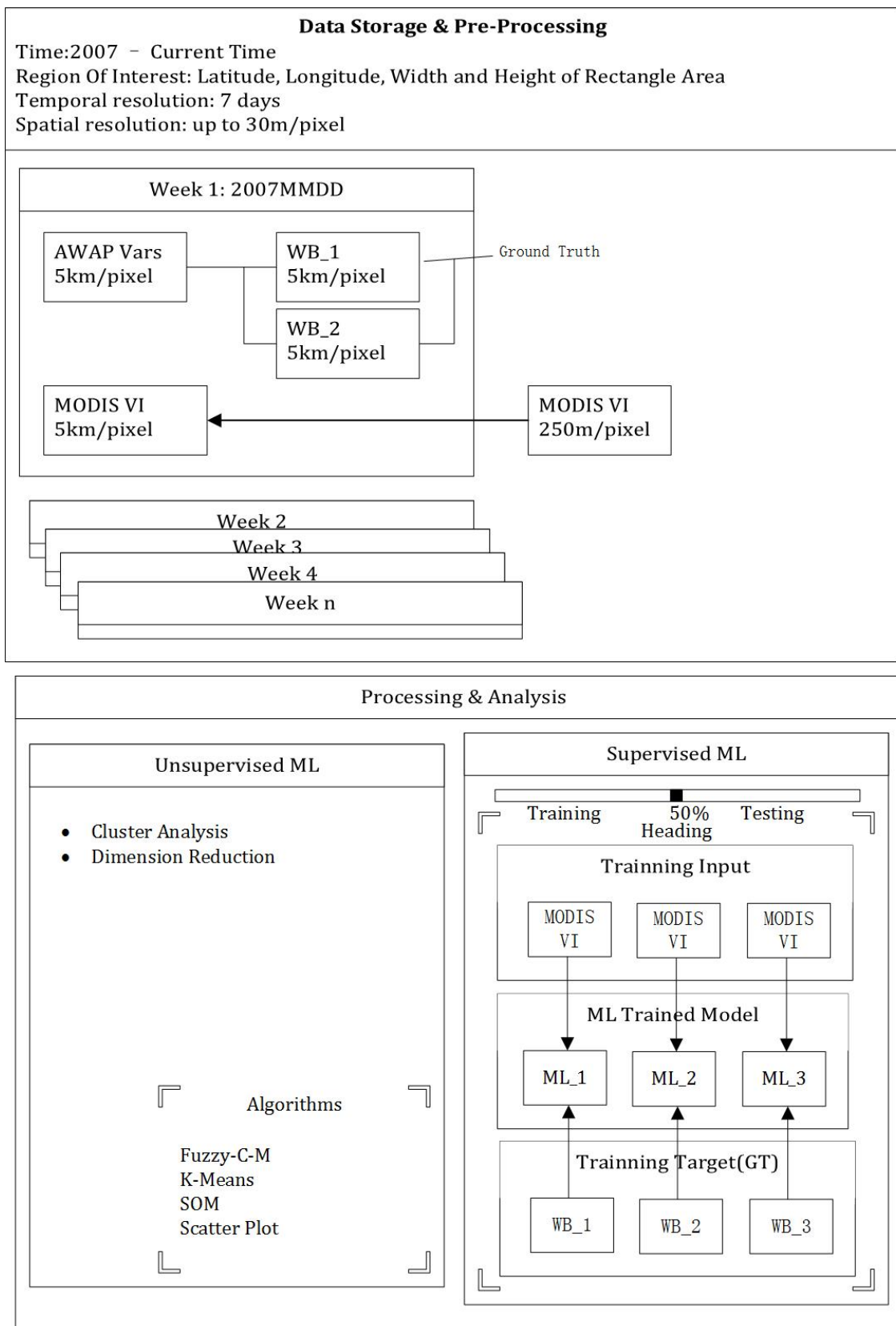


Fig. 1: Preprocessing and Analysis Design

- Visualisation of data
- Practical application with the customer: Houston farm case study

## 5.1 Analysis

### 5.1.1 Cross Validation of MODIS VI with Landsat Bands

- 1) Filtering Landsat data by thresholding its cloud-cover level.
- 2) Use formula to calculate VI with different band values from Landsat. (Do literature)
- 3) Extract Landsat data(30m resolution) for the available MODIS data points(250m resolution), then normalize.
- 4) Use established method to find correlation of MODIS VI and Landsat calculated VI(GT)
- 5) Analyse the results and draw conclusions. Find out whether MODIS VI is a accurate derived product for vegetation index, if not why.

### 5.1.2 High resolution Spatial estimation of water balance

- 1) Use formula to calculate Water Balance with multiple variables from AWAP. (Do literature)
- 2) Extract MODIS data(250m resolution) for the available AWAP data points(5km Resolution)
- 3) Supervised Machine Learning Approach:
  - Training Input: MODIS VI, Digital Elevation Data
  - Training Target: AWAP calculated Water Balance Value
  - Testing Input: MODIS VI, DED
  - Testing Target: AWAP calculated Water Balance Value (Historic Data)Unsupervised Machine Learning Approach:
  - Training Input: AWAP calculated Water Balance
- 4) Analyse the results, the precision of the model's estimation
- 5) If acceptable, deploy the algorithm to data points where MODIS VI and DED are available whereas AWAP is not, at a resolution of 250m/pixel. Perform spatial-temporal estimation of Water Balance
- 6) Produce visualisation of Water Balance on a surface

### 5.1.3 Prediction of Water Balance surface using Data-driven approach

- 1) Recursive Bayesian estimation:
  - Input Data: Estimated Water Balance at 250m resolution for weeks 1 to n
  - Output Data: Predicted Water Balance at 250m resolution for week n+1
- 2) Analyse the results for precision and use it for actual visualisation data, predicting the water balance level of the given case study area.
- 3) Develop application based on the data.
  - Mobile Application
  - Web Service

## 6 CONCLUSION

- Further development, generic system that can be used for many other analysis. Potential and ongoing work
- Concludes the work, publication etc.

## APPENDIX

Section Name	Commence Date	Estimated Duration	Actual Duration	Due date	Notes
Water Balance	3 Mar 2014	1-2 Weeks	2 Weeks	16 Mar 2014	
Data Integration	17 Mar 2014	1-2 Weeks		30 Mar 2014	
Mobile App	31 Mar 2014	1 Week		6 Apr 2014	
Introduction	7 Apr 2014	1 Week		13 Apr 2014	
Area-wise	14 Apr 2014	2 Weeks		27 Apr 2014	
Conclusion, Abstract	28 Apr 2014	1 Week		5 May 2014	

TABLE 1: Due dates for thesis sections