Project Process

Automated Scales for real-time weight capture

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Aug 8, 2017

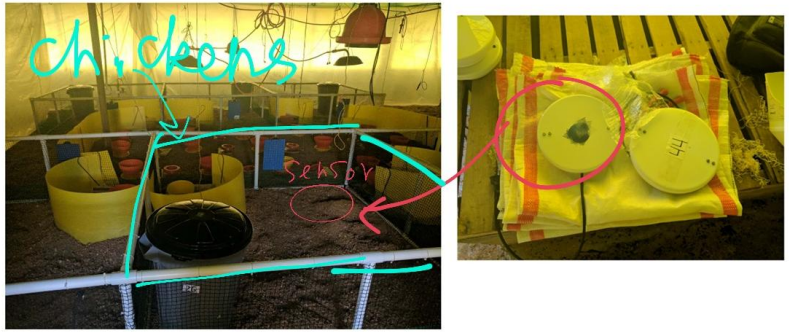
Requirement

Input parameters:

- Sensor data pulled from api
- A latest batch date
- Standard guide data

Output:

- Average weight of each data point in the last day/hours

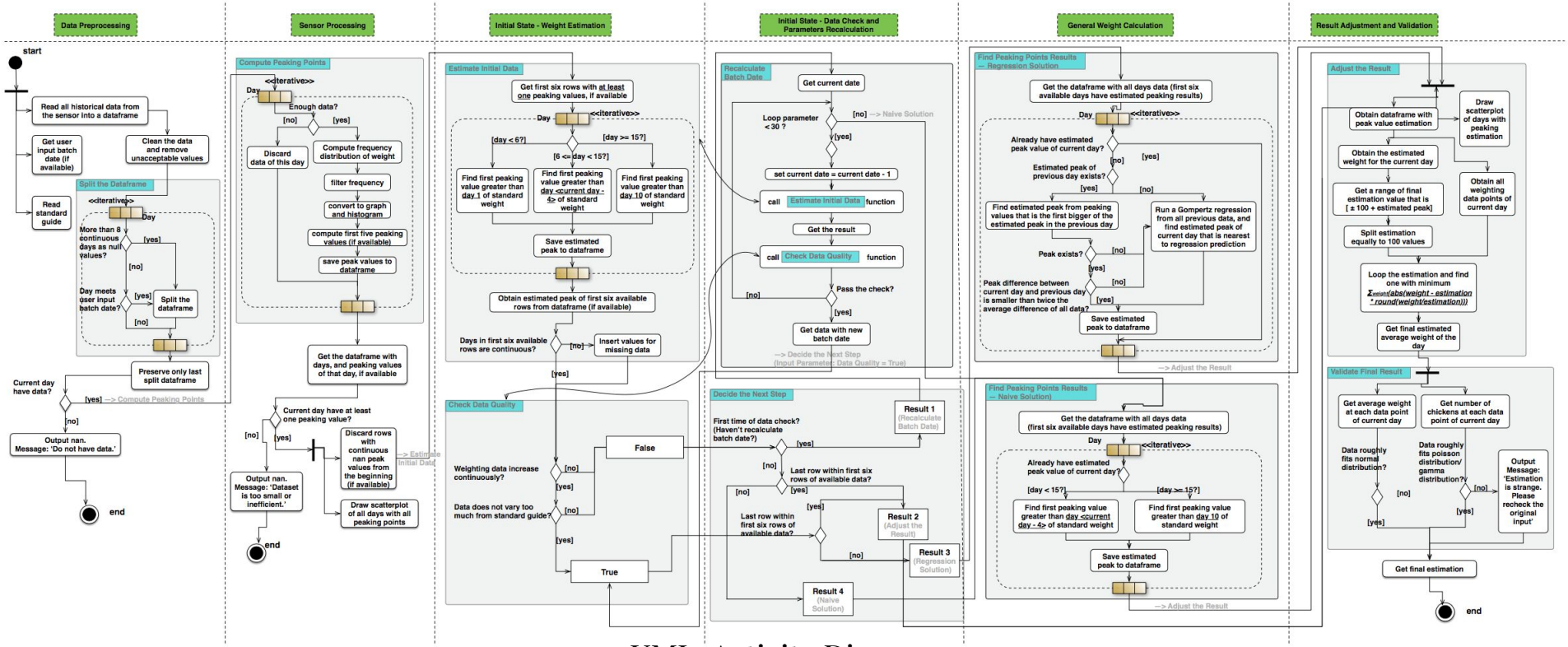


Premex's Farm

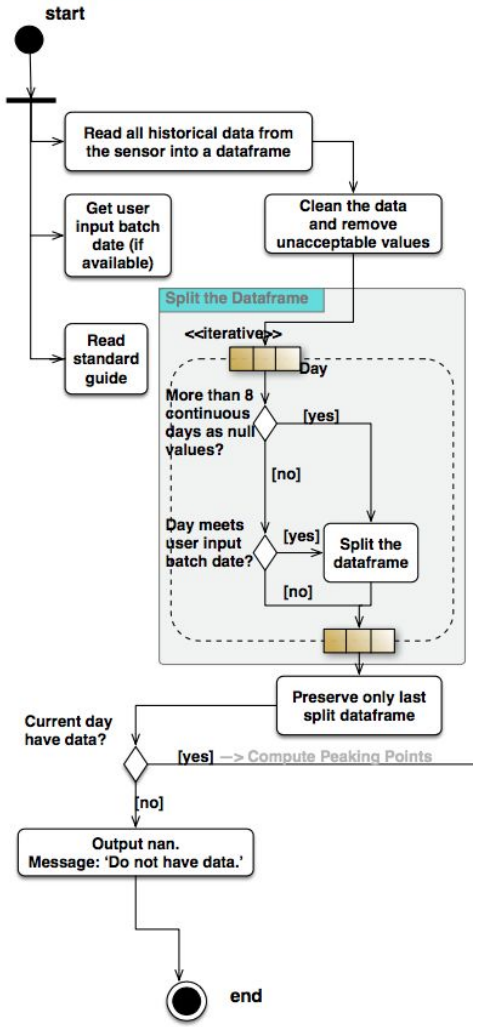
Implementation

1. Data preprocessing
2. Sensor processing
3. Weight estimation in initial state
4. Data check/Parameter recalculation
5. General weight calculation
6. Result adjustment and validation

Design



UML, Activity Diagram



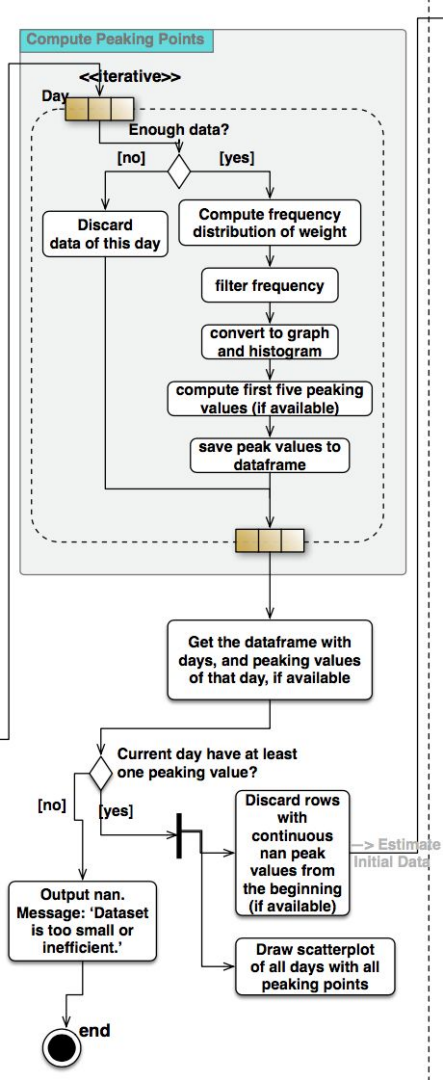
1. Data Preprocessing

1) Read in all parameters

2) Split the dataframe

3) Preserve latest dataframe

Function: `df_split()`:
- split the dataframe

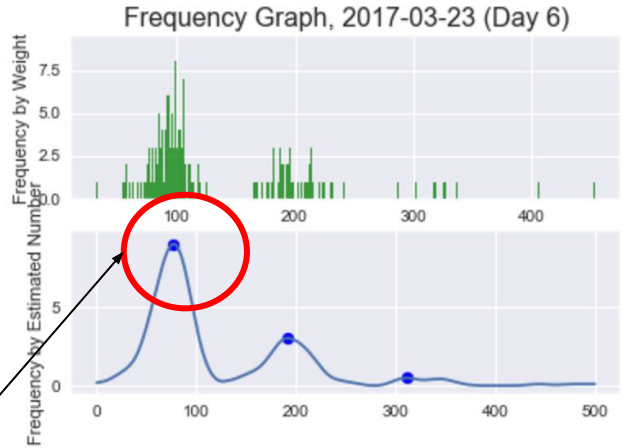


2. Sensor Processing

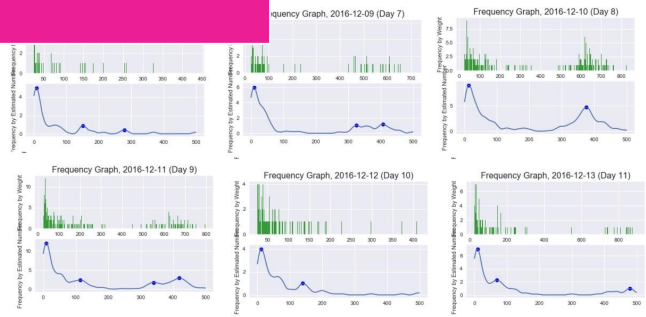
1) Process data day by day

2) For each day, compute frequency distribution and draw histogram

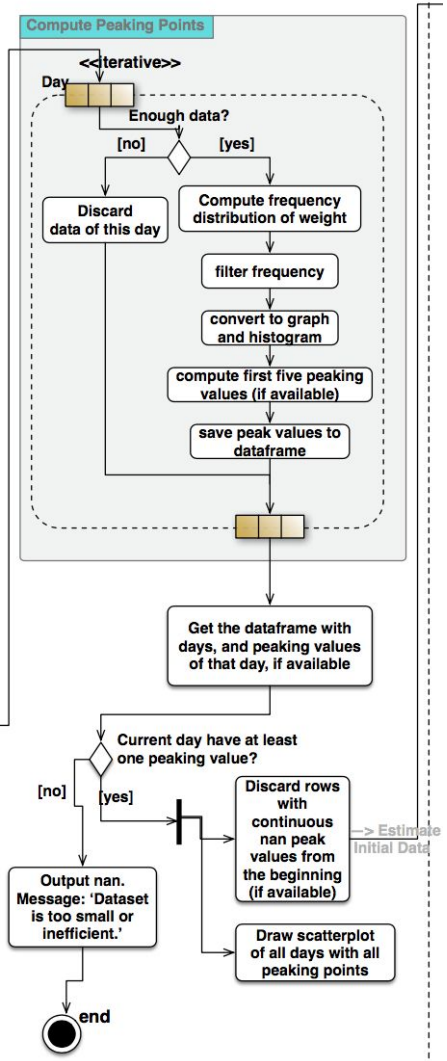
3) Find all peaking values



Biggest Problem 1:
How to find this peaking point???



Function: `find_peaking_point()`:
- For each day, find peaking points from histogram

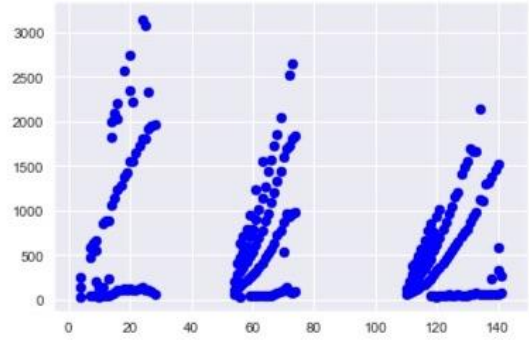


2. Sensor Processing (cont.)

Biggest Problem 2: How to find the points in this line???

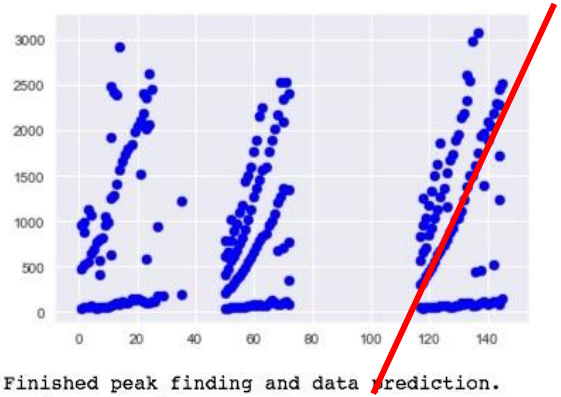
4) Get a scatterplot of all days' values

```
Begin processing Sensor1.
SUCCESS 584302380c51e0353c9d8e9c
Finished pulling data from api.
```




```
Finished peak finding and data prediction.
```

```
Begin processing Sensor2.
SUCCESS 584493520c51e008d3e88909
Finished pulling data from api.
```




```
Finished peak finding and data prediction.
```

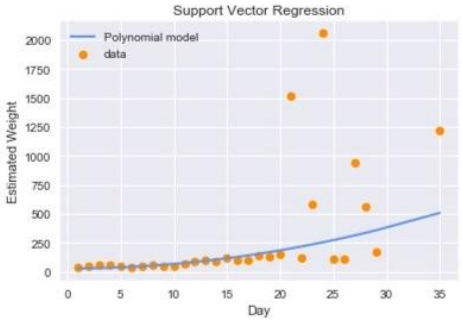
How to find the peaking point???

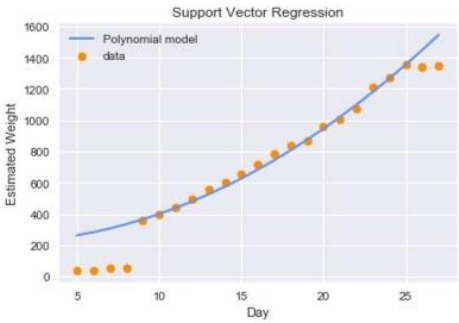
Discarded Approach 1:

Using standard data as compassion.

Discarded because:

1) Logic itself is dubious
2) Batch date may be unknown or inaccurate



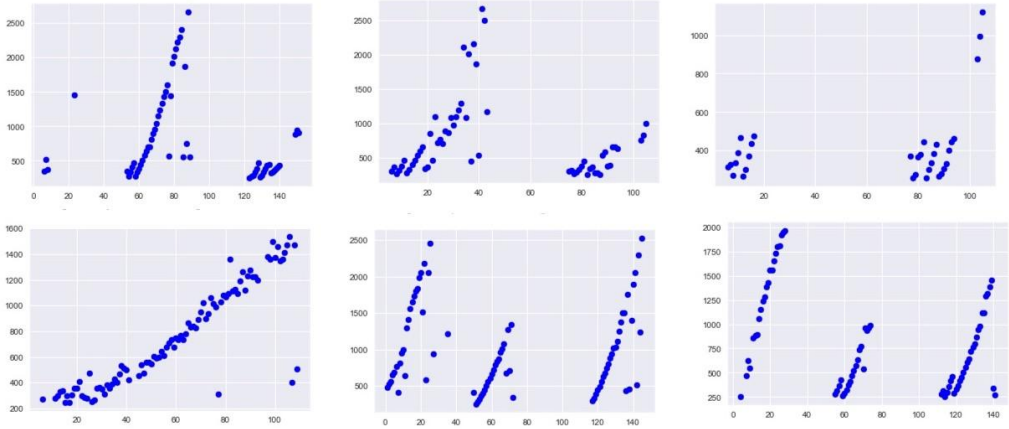


Discarded Approach 2:

Do regression backwards.

Discarded because:

The system is automatic



How to find the peaking point???

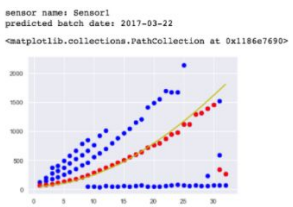
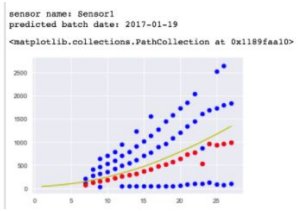
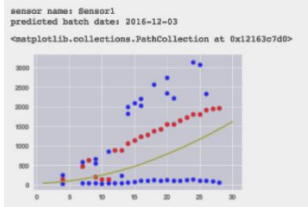
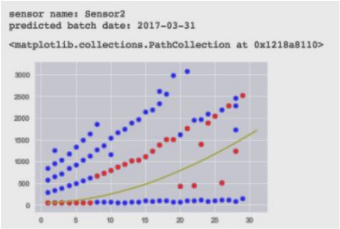
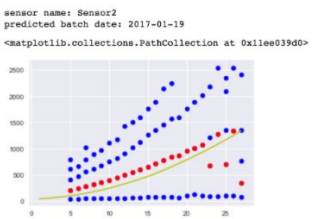
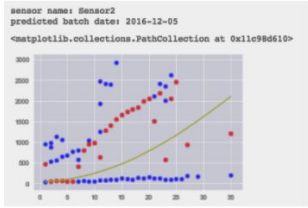
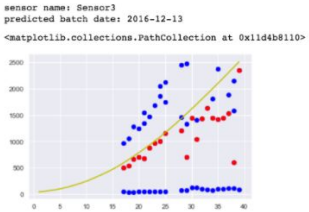
Discarded Approach 3:

Using a simple one-point method.

If date < 10:
- Discard weighting date less than standard (day 1)
- Choose the smallest weight from remaining peaking point

Elif date > 10:
- Discard weighting date less than standard (day 10)
- Choose the smallest weight from remaining peaking point

Discarded because:
Estimation is not accurate.

Name			
'Sensor 1'		 Given Batch Date	
'Sensor 2'		 Given Batch Date	
'Sensor 3'	 Given Batch Date		

How to find the peaking point???

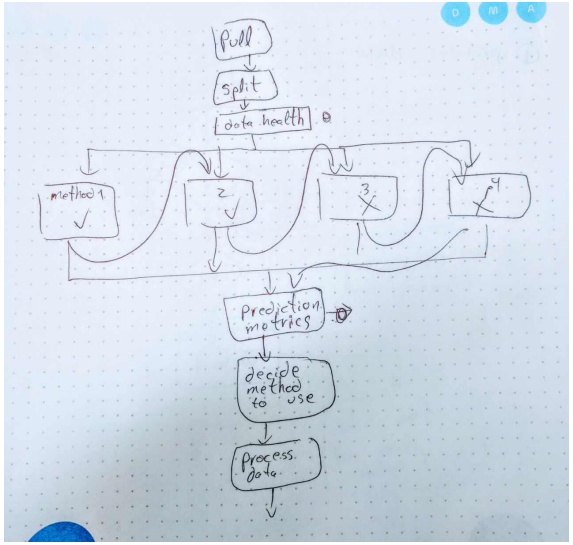
Discarded Approach 4:

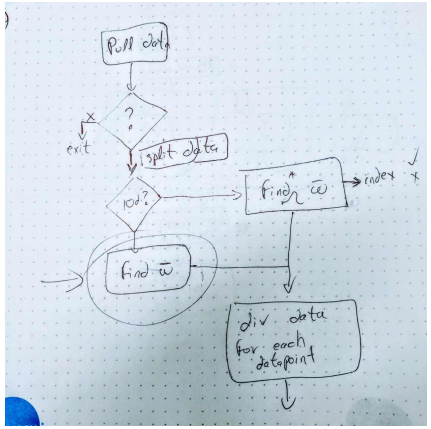
Cross validate several methods.

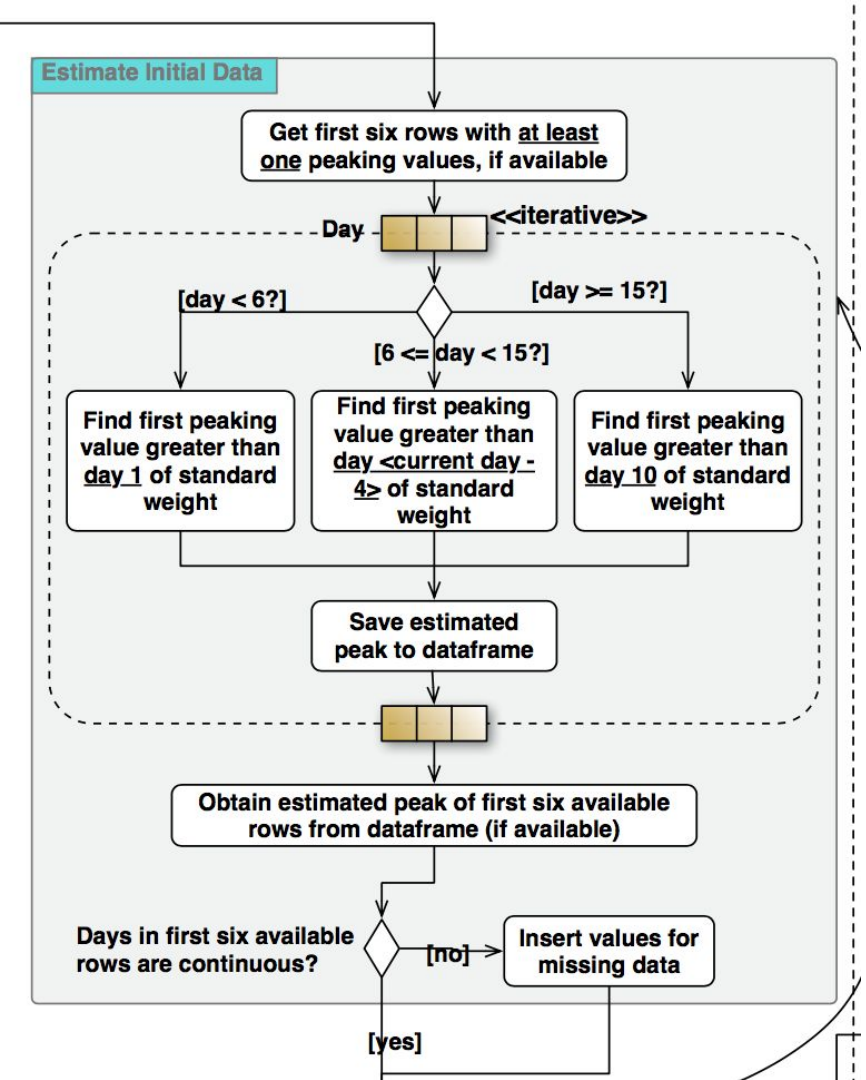
Method 1: One-point Method (Without assuming batch date)
Method 2: Standard Comparison Method (Have to assume batch date)
Method 3: MSE Method (Without assuming batch date)
Validation: if the output is compellent.
Regression: Regression Method (for day > 4)

Discarded because:
Sometimes cannot find right estimation anyway using all methods.

```
Try method 1 + Regression
|   __________
|→|  validate  |---------→ pass validation → Output
   | method 1 |     |---→ reject validation
                                |→ If there's    → Try method 2 + Regression
                                |  a batch date     |   __________
                                |                   |→ |  validate  |--→ pass validation → Output
                                |                      | method 2 |  |--→ reject validation
                                |                                          |
                                |                        | ---------------------------|
                                |                        |
                                |--> If there's not → Try method 3 + Regression
                                     a batch date     |   __________
                                                      |→|  validate  |--→ pass validation → Output
                                                        | method 3 |  |--→ reject validation
                                                                  |--> Output error message
```



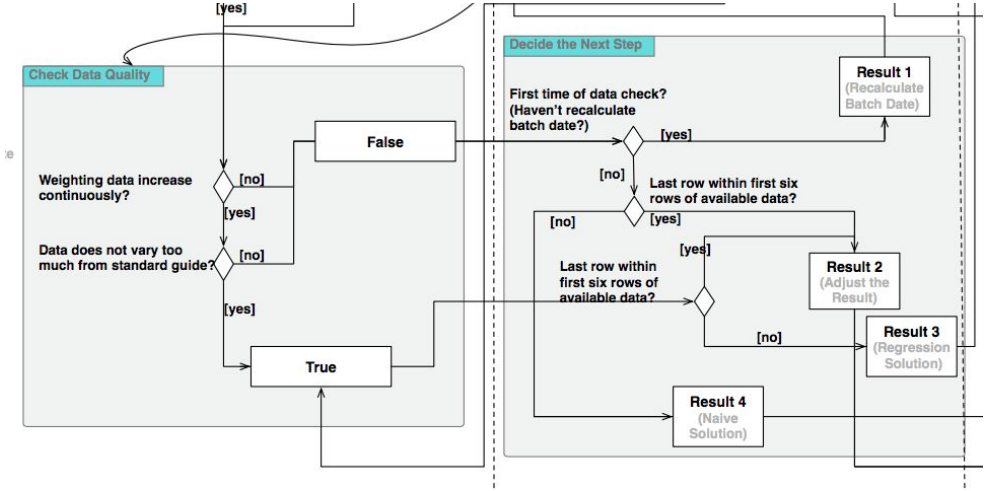




3. Weight Estimation in Initial State

Get first six days of estimation, if these data exists.

Function: `estimate_initial()`:
- Estimate the peaking point of first six days of data, if it exists.



4. Data Check/ Parameters Recalculation

1) Check the quality of first six days of data estimation

2) Get four result choices:

- Result 1: Recalculate batch date ⇸ call **`recalculate_batch_date()`**

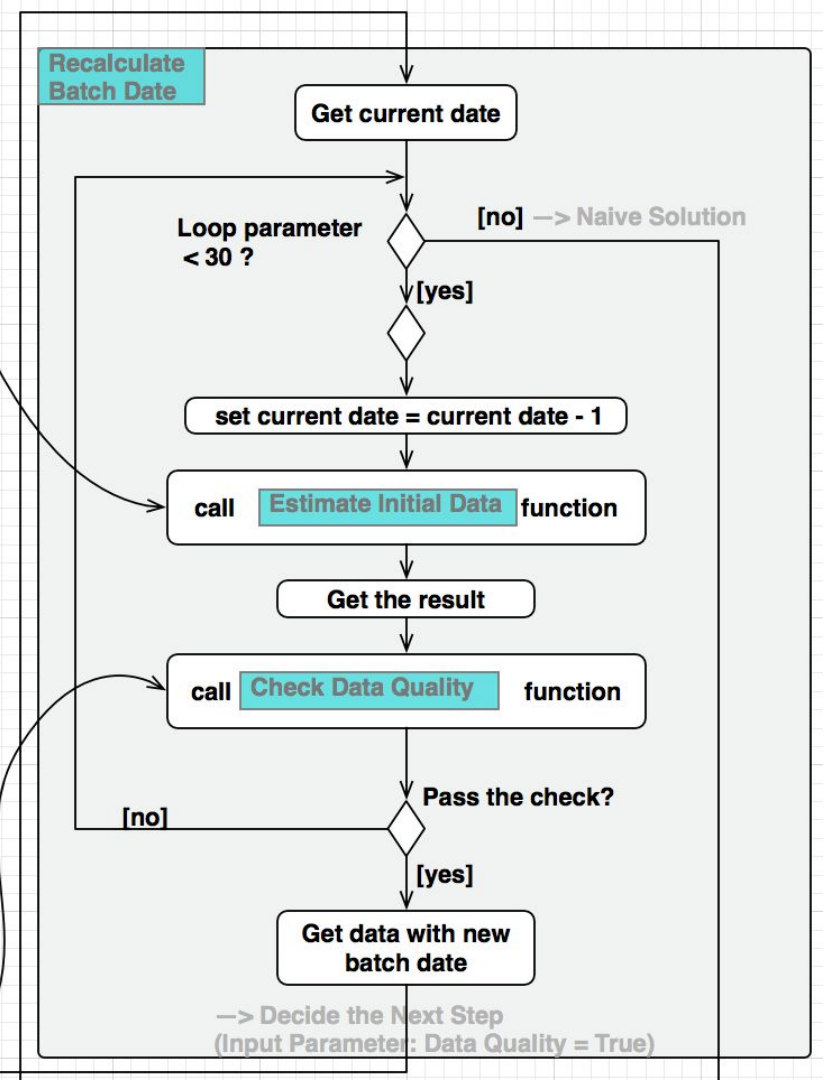
- Result 2: Adjust the result -⇸ call **`adjust_result()`**

- Result 3: Regression solution -⇸ call **`find_peaking_point_regression()`**

- Result 4: Naive solution -⇸ call **`find_peaking_point_naive()`**

Function: `check_data_quality()`:
- Check if first six days of data estimation is acceptable

Function: `decide_next_step()`:
- Decide which route the program should go on



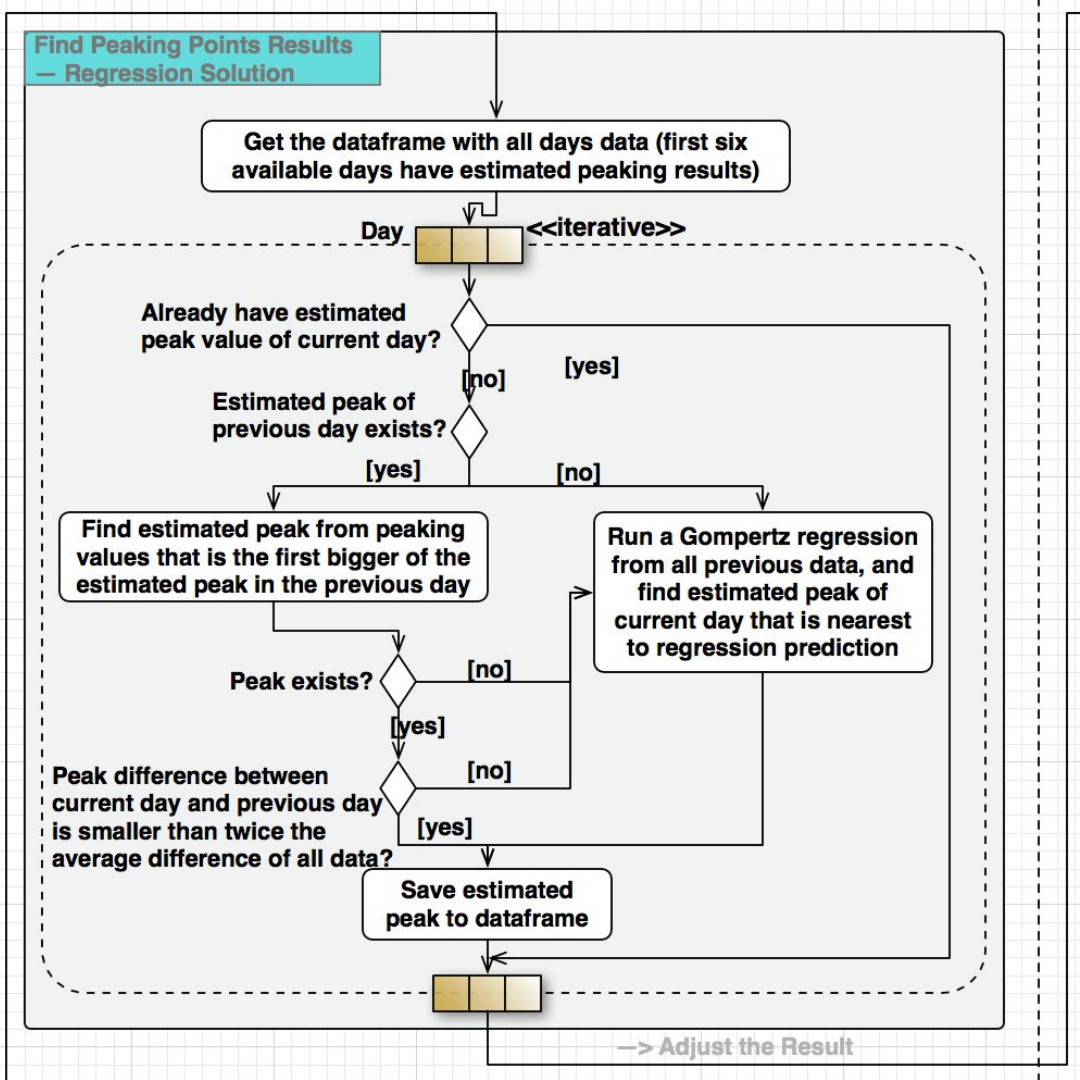
4. Data Check/ Parameters Recalculation (cont.)

Function:
`recalculate_batch_date()`:
- Recalculate batch date

5. General Weight Calculation (1)

Using regression approach

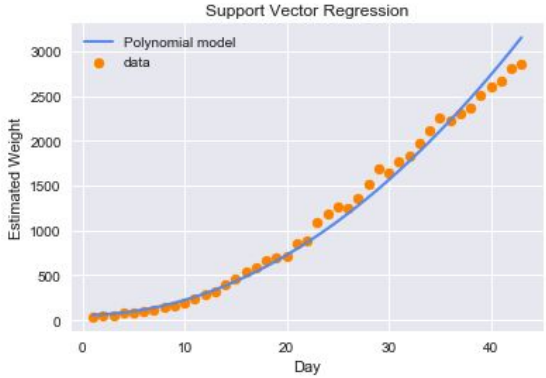
Function:
`find_peaking_point_regression()`:
- Find peaking points using a regression approach



Which Regression??

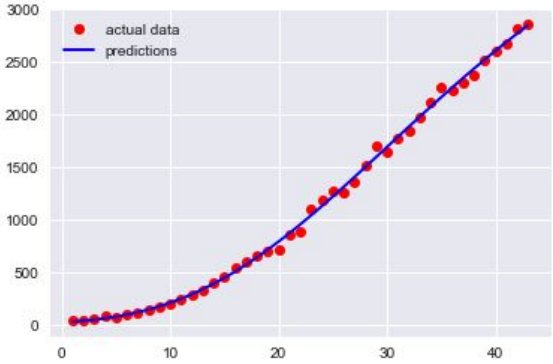
Approach 1: SVR Regression

Pros: Accurate
Cons: Very slow



Approach 2: Gomperts Regression

Pros: Fast; accurate in most times
Cons: Overfitting problem; Can not call the function for many times



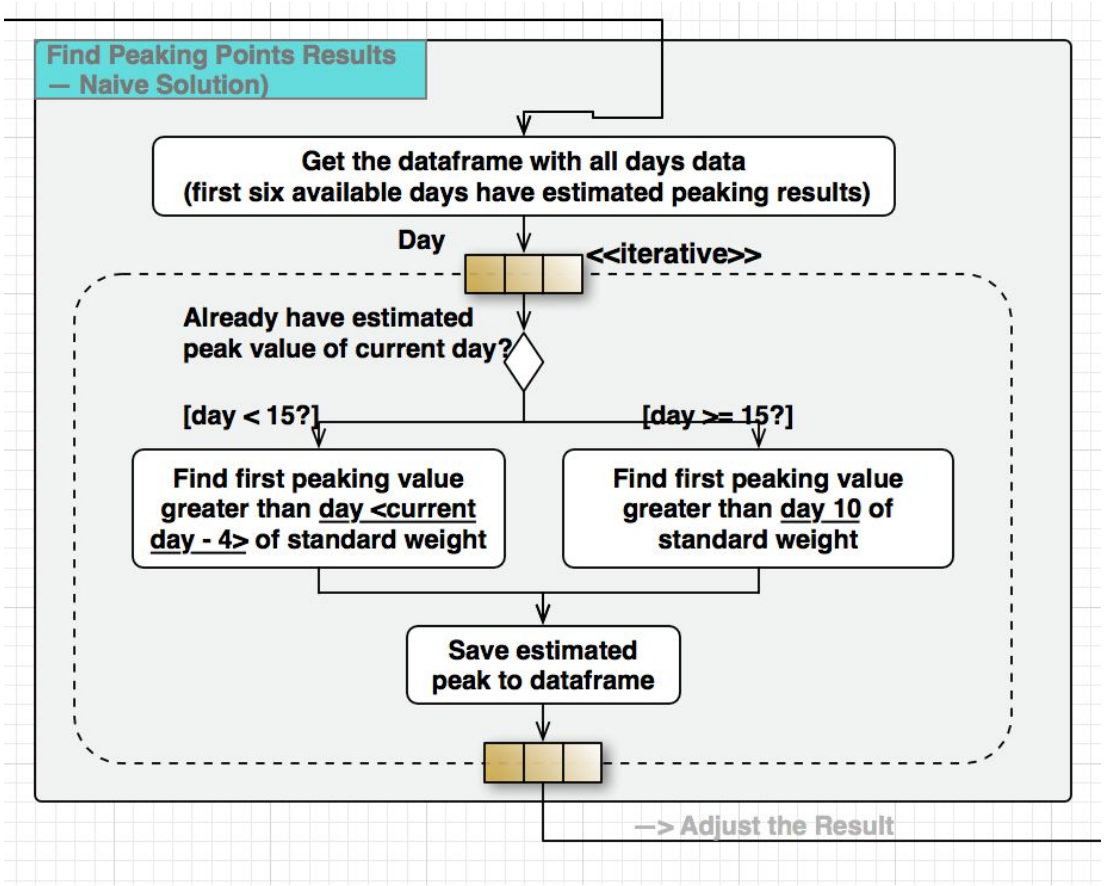
Approach 3: Self-created Simple Regression

Pros: Easy and quick
Cons: Not so accurate

5. General Weight Calculation (2)

Using a naive approach

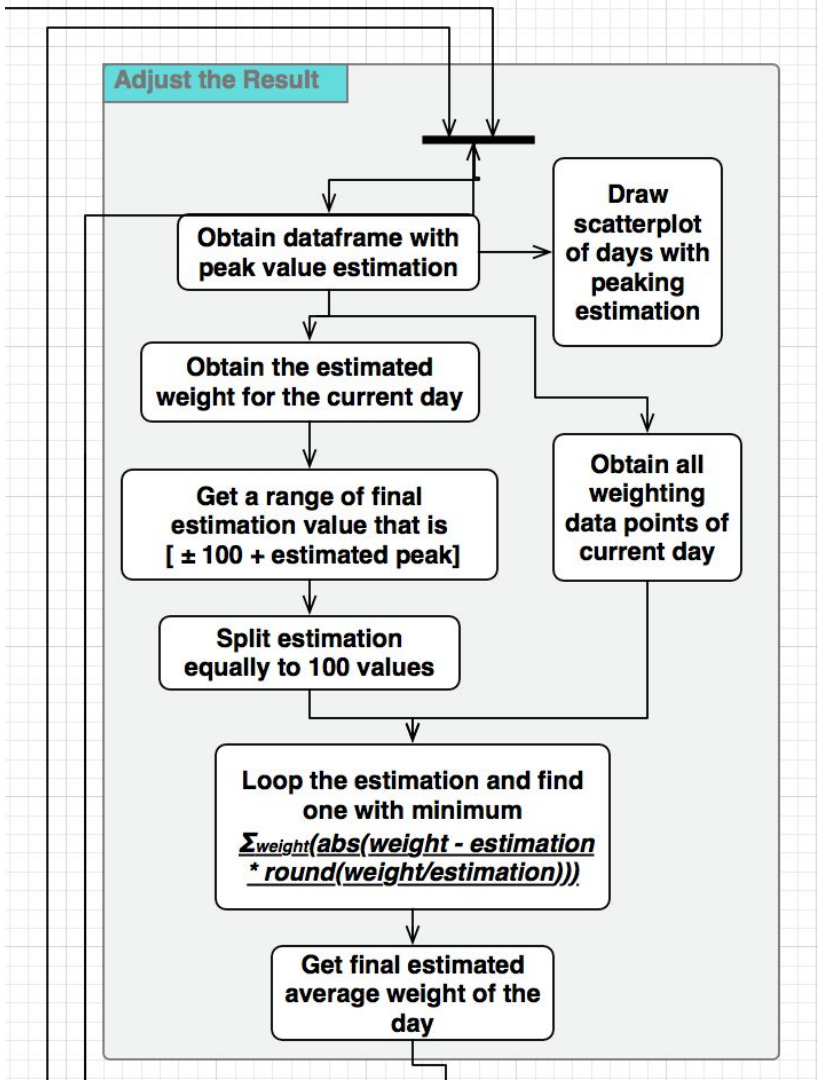
Function:
`find_peaking_point_naive()`:
- Find peaking points using a naive approach



6. Result Adjustment and Validation

Adjust the result using an iterative approach.

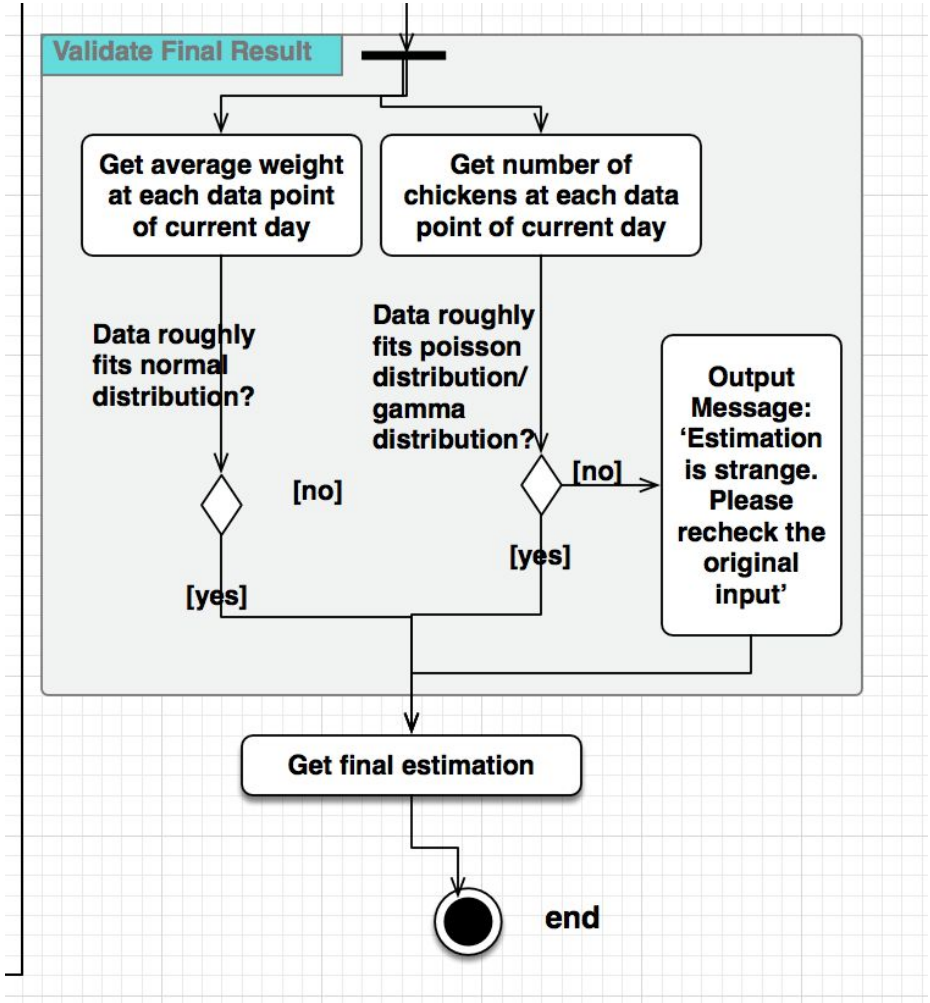
Function:
`adjust_result()`:
- adjust the result



6. Result Adjustment and Validation

Validate final result.

Function:
`validate_result ()`:
- Validate final result



TBD

No	Priority	Features	Difficulty	Estimated Time
1	***	Recalculate batch date	***	4- 5 hours
2	***	Find peaking points results (data passed check)	**	2 - 3 hours
3	***	Check data Quality	***	2 - 3 hours
4	**	Insert missing data	**	0.5 - 1 hour
5	**	Find peaking points results (data not passed check)	**	1 - 2 hours
6	**	Adjust the result	***	3 - 4 hours
7	**	Validate final result	***	3 - 4 hours
8	*	Split the dataframe	**	2 - 3 hours