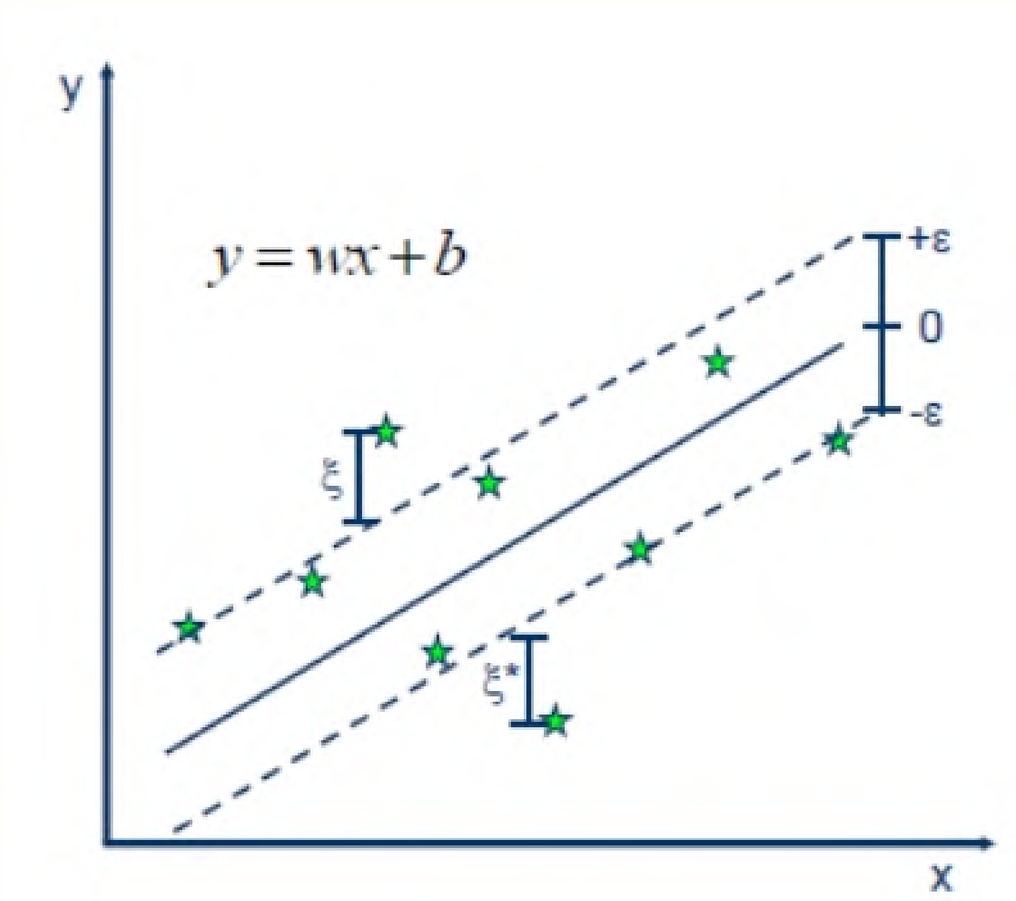
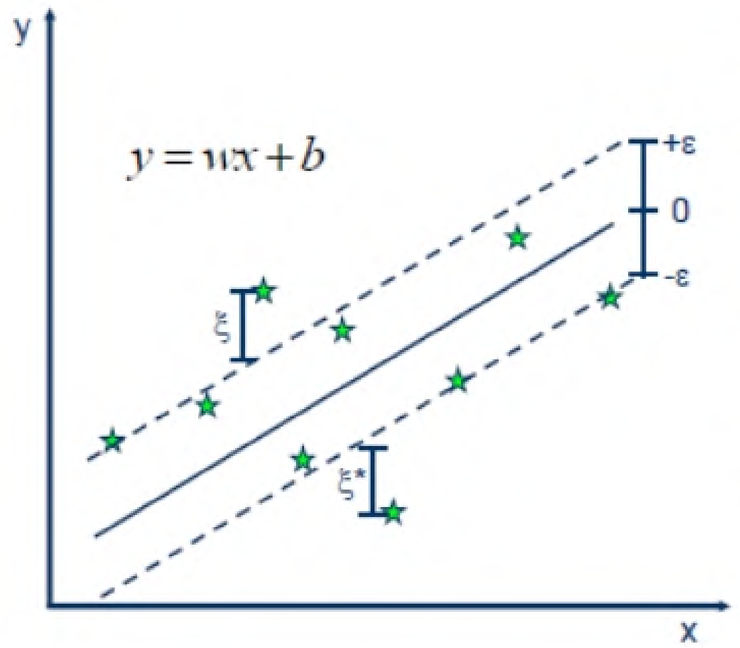
SUPPORT VECTOR REGRESSION

SVR

Support Vector Regression (SVR) is a supervised machine learning algorithm used for regression tasks. It aims to predict continuous output variables by finding a hyperplane that minimizes the difference between predicted and actual values within a specified margin of tolerance.



Soft margin SVR



- Minimize:

$$\frac{1}{2}\|w\|^2 + C\sum_{i=1}^{N}(\xi_i + \xi_i^*)$$

- Constraints:

$$y_i - wx_i - b \le \varepsilon + \xi_i$$

$$wx_i + b - y_i \le \varepsilon + \xi_i^*$$

$$\xi_i, \xi_i^* \ge 0$$

Constraint：
Any thing within the margin or some slack value is acceptable.

Company name

Application: Robot Motion and Goal prediction using SVR

```
% Read data from CSV file
data = readtable('robot.csv');
```

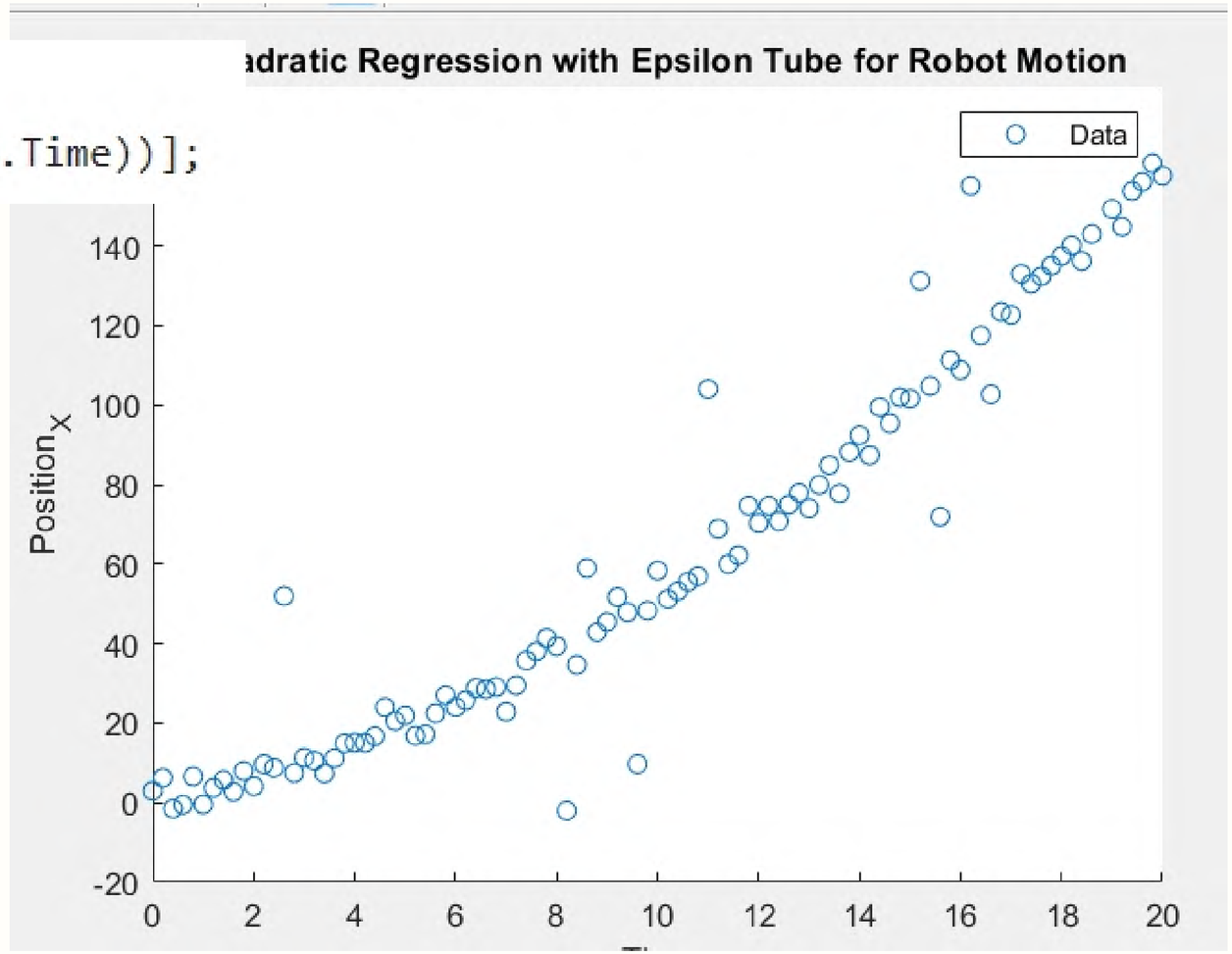
	A	B	C	D
1	Time	Position_X	GoalAchieved	
2	0	3	1	
3	0.2	6.26	1	
4	0.4	-1.48	1	
5	0.6	-0.51	1	
6	0.8	6.61	1	
7	1	-0.45	1	
8	1.2	3.74	1	
9	1.4	5.72	1	
10	1.6	2.75	1	
11	1.8	7.98	1	
12	2	4.12	1	
13	2.2	9.67	1	
14	2.4	8.78	1	
15	2.6	51.97	-1	
16	2.8	7.47	1	
17	3	11.32	1	
18	3.2	10.54	1	
19	3.4	7.36	1	
20	3.6	11.18	1	
21	3.8	14.91	1	

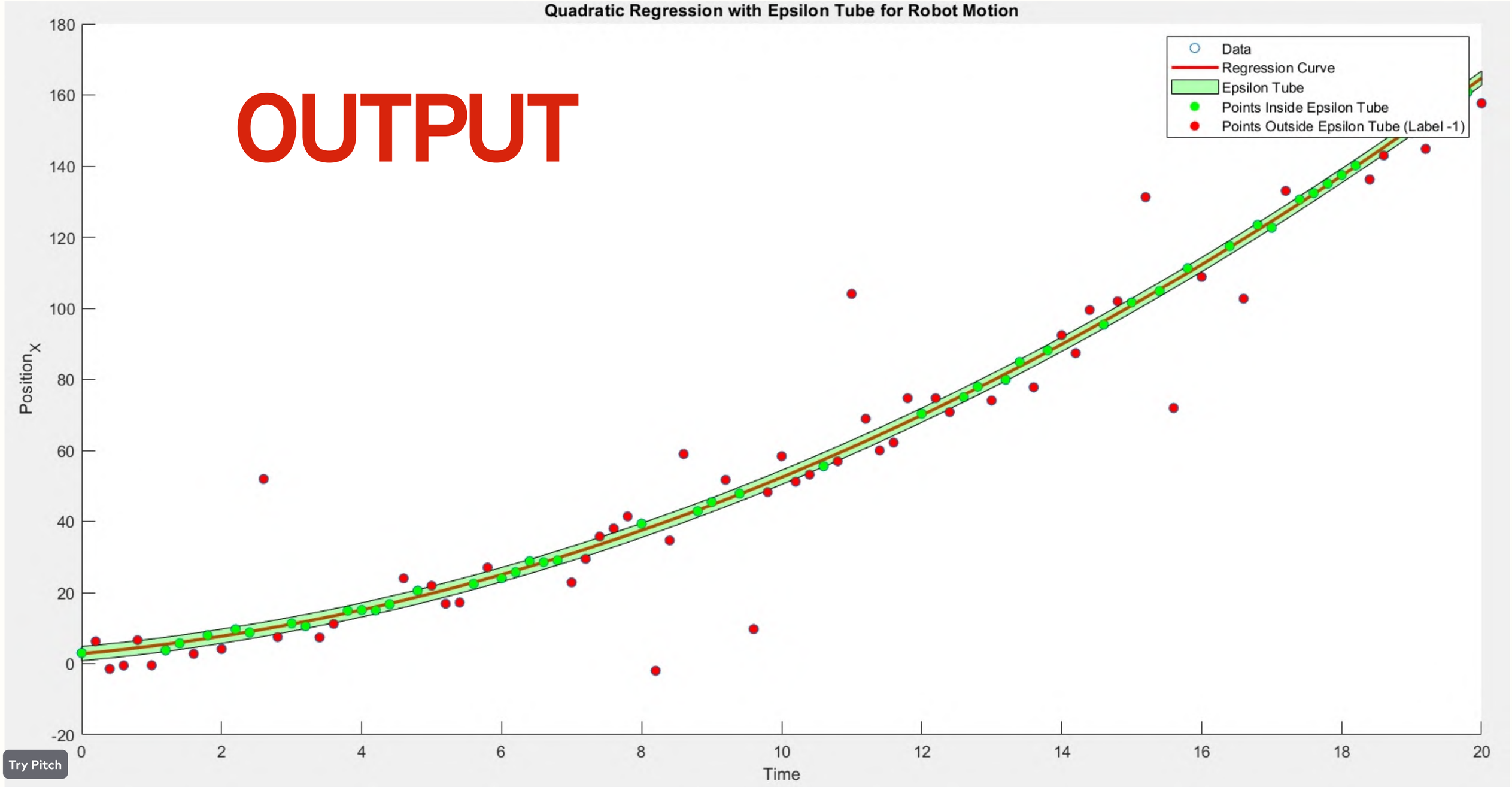
14.4	99.48	1
14.6	95.38	1
14.8	101.93	1
15	101.61	1
15.2	131.23	-1
15.4	104.79	1
15.6	71.9	-1
15.8	111.25	1
16	108.8	1
16.2	155.1	-1
16.4	117.48	1
16.6	102.68	-1
16.8	123.43	1
17	122.65	1
17.2	132.98	1
17.4	130.55	1
17.6	132.38	1

For making this into a Non - linear regression we will make the Data set into Non - Linear Data set

```
% Features
X = [data.Time.^2, data.Time, ones(size(data.Time))];
```

Training Data




Quadratic Regression with Epsilon Tube for Robot Motion
OUTPUT
Data
Regression Curve
Epsilon Tube
Points Inside Epsilon Tube
Points Outside Epsilon Tube (Label -1)
Position_X
Time
180
160
140
120
100
80
60
40
20
0
-20
0
2
4
6
8
10
12
14
16
18
20

Try Pitch