In [261]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from cvxopt import matrix, solvers
%matplotlib inline

# load the wines data into a pandas dataframe
fname = r'wines.csv'
wines = pd.read_csv(fname,delimiter=';',header=0)
wines.head()
```

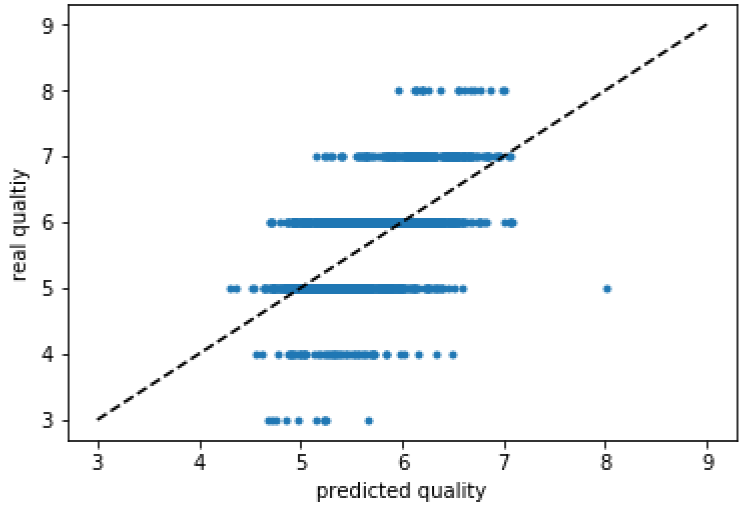
Out[261]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	a
0	7.4	0.70	0.00	1.9	0.076	11.0	34.0	0.9978	3.51	0.56	[illegible]
1	7.8	0.88	0.00	2.6	0.098	25.0	67.0	0.9968	3.20	0.68	[illegible]
2	7.8	0.76	0.04	2.3	0.092	15.0	54.0	0.9970	3.26	0.65	[illegible]
3	11.2	0.28	0.56	1.9	0.075	17.0	60.0	0.9980	3.16	0.58	[illegible]
4	7.4	0.70	0.00	1.9	0.076	11.0	34.0	0.9978	3.51	0.56	[illegible]

In [281]:
```
# dimension of the data
n = wines.shape[0]
m = wines.shape[1]-1
# augment the X and parse Y
min_max_scaler = preprocessing.MinMaxScaler()
X = np.hstack((wines.iloc[:,:-1],np.ones((n,1))))
Y = wines.iloc[:,-1].astype('double')
# c is (m+1+n)
# setting the coefficients in c corresponding to a_j and b to zeros and averag
e the z's
c = matrix(np.hstack([np.zeros(m+1),np.ones(n)/n]))
# A is 2n by (m+1+n)
XX = np.vstack([-X,X])
I = np.vstack([-np.eye(n),-np.eye(n)])
A = np.hstack([XX,I])
# we need to format this for the solver to include the constraints on z's
G = matrix(np.vstack([A,np.hstack([np.zeros((n,m+1)),-np.eye(n)])]))
# b is 2n
b = np.hstack([-Y,Y])
# again we format the b to include constraints on the z's
h = matrix(np.hstack([b,np.zeros(n)]))
# pass the matrices to the solver
sol = solvers.lp(c, G, h,solver='splk')
```

```
     pcost       dcost       gap    pres   dres   k/t
 0:  0.0000e+00  6.9562e-16  4e+00  8e-01  8e-15  1e+00
 1:  2.7051e-01  1.4091e-01  1e+00  2e-01  5e-15  9e-02
 2:  4.0476e-01  3.6896e-01  2e-01  4e-02  7e-13  1e-02
 3:  4.6439e-01  4.5069e-01  8e-02  1e-02  4e-12  4e-03
 4:  4.8118e-01  4.7506e-01  3e-02  6e-03  2e-11  1e-03
 5:  4.8776e-01  4.8474e-01  2e-02  3e-03  5e-12  4e-04
 6:  4.9221e-01  4.9144e-01  4e-03  7e-04  1e-11  8e-05
 7:  4.9331e-01  4.9310e-01  1e-03  2e-04  3e-12  1e-05
 8:  4.9357e-01  4.9349e-01  4e-04  7e-05  3e-11  4e-06
 9:  4.9369e-01  4.9367e-01  1e-04  2e-05  2e-11  9e-08
10:  4.9374e-01  4.9373e-01  3e-05  5e-06  3e-11  2e-08
11:  4.9375e-01  4.9375e-01  1e-06  2e-07  8e-12  7e-10
12:  4.9375e-01  4.9375e-01  1e-08  2e-09  3e-11  7e-12
Optimal solution found.
```

In [283]:
```
d = np.asarray(sol['x'][:12])
plt.plot(X.dot(d),Y,'.')
plt.plot([3,9],[3,9],'k--')
plt.xlabel('predicted quality')
plt.ylabel('real qualtiy')
plt.show()
```



In [287]:
```
print('The average L1 loss is:')
sol['primal objective']
```

Out[287]: 0.4937487285454359