

## ex8 tutorial for cofiCostFunc()

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Vectorized tutorial for cost and gradients with regularization

Definitions:

R: a matrix of observations (binary values). Dimensions are (movies x users)

Y: a matrix of movie ratings: Dimensions are (movies x users)

X: a matrix of movie features (0 to 5): Dimensions are (movies x features)

Theta: a matrix of feature weights: Dimensions are (users x features)

- Compute the predicted movie ratings for all users using the product of X and Theta. A transposition may be needed.

Dimensions of the result should be (movies x users).

- Compute the movie rating error by subtracting Y from the predicted ratings.

- Compute the "error\_factor" by multiplying the movie rating error by the R matrix. The error factor will be 0 for movies that a user has not rated. Use the type of multiplication by R (vector or element-wise) so the size of the error factor matrix remains unchanged (movies x users).

**(Note:** there is a quirk in the submit grader's test case that requires you to use the R matrix to ignore movies that have had no ratings).

Calculate the cost:

- Using the formula on Page 9 of ex8.pdf, compute the unregularized cost as a scaled sum of the squares of all of the terms in error\_factor. The result should be a scalar.

- Test your code using ex8\_cofi.m and the additional test cases. You should get a passing grade for this portion from the submit script.

Calculate the gradients (ref: the formulas on Page 10 of ex8.pdf):

- The X gradient is the product of the error factor and the Theta matrix. The sum is computed automatically by the vector multiplication. Dimensions are (movies x features)

- The Theta gradient is the product of the error factor and the X matrix. A transposition may be needed. The sum is computed automatically by the vector multiplication. Dimensions are (users x features)

- Test your code, then submit this portion.

Calculate the regularized cost:

- Using the formula on the top of Page 13 of ex8.pdf, compute the regularization term as the scaled sum of the squares of all terms in Theta and X. The result should be a scalar. Note that for Recommender Systems there are no bias terms, so regularization should include all columns of X and Theta.

- Add the regularized and un-regularized cost terms.

- Test your code, then submit this portion.

Calculate the gradient regularization terms (ref: the formulas in the middle of Page 13 of ex8.pdf)

- The X gradient regularization is the X matrix scaled by lambda.

- The Theta gradient regularization is the Theta matrix scaled by lambda.

- Add the regularization terms to their unregularized values.

- Test your code, then submit this portion.  
Done.

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