

MS4105 Project 2017

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Complete successfully the tasks below for a maximum grade of 30%. Closing date for completed work is Friday 3 November (end Week 9). Use the upload system to upload your work as a single archive file.

You can download some graphics files from <http://jkcray.maths.ul.ie/ms4105/TestPics/>.

1. Choose one or find one of your own (not too big say $\leq 500 \times 500$ and inoffensive in content) — call it `mypic.jpg` (or `mypic.png`).
2. Write a Matlab script that reads the file `mypic.jpg` into a multi-dimensional array A using the `imread` command.
3. Extend your script so that it displays your matrix as a graphic image using the `image` command.
4.
 - Use the built-in `matlab svd` command to compute the singular value decomposition of the colour layers L : R, G & B of A .
 - Use both the methods discussed in class ($AV = U\Sigma$ method and $AV = QR$ method) to compute the singular value decomposition of each colour layer L of A .
 - You may wish to write Matlab function m-files to implement the two alternative methods.
 - Determine which method is most accurate by comparing $\|L - U\Sigma V^*\|$ for the three colour layers L of A .
 - Also compare the accuracy by evaluating $\|U^*U - I\|$ and $\|V^*V - I\|$ for each layer L and for each method.
5. Having selected a SVD method, make a semilog plot (as in the Notes) of the singular values of each layer and make a reasonable choice of low-rank cutoff r_0 .
6. For (say 5) equally spaced values of i from 10 to r_0 , construct the best rank- i approximation to A and plot them using the `image` command.
7. Write a short PDF document using \LaTeX that includes your plots, your m-file(s) and a clear explanation with conclusions as appropriate.