# GI14 / M054 Machine Vision: Homework #2
Due 13th January 2017 at 23:55pm
Worth 10% of your overall grade
Submit online, through Moodle
(Grading scheme: 50% is a basic pass, 70% is a low 'A')

For this homework, we'll revisit two practicals, from the 8th and 9th weeks: Homographies and Particle Filters. Though some of this will feel repetitive, it is meant to solidify what we learned in the practicals. There are multiple parts (plus optional extra credit), so please read the instructions carefully. Everything you turn in must be YOUR OWN WORK, except obviously the helper-code and data given to you on Moodle. See below for more details. As always, list names/references for anything you're submitting that is not your own work.
Late Policy: Within 24 hours late: 90% of marks, within 24-48 hours late: 80% of marks, later than 48 hours: 0%.

**What to turn in** (all inside one YourName.zip file):
- One file containing your report, in either .PDF or .DOC format. Like Homework #1, you should complete all the TO DO's. For every figure or plot that is generated by the code (for videos, a few frames are enough), put a copy in your report, and write 1-3 sentences (maximum) explaining what the figure shows or pros/cons of what is happening.
- One folder containing all your code (and optional Extra Credit)

(Read the **`Special Notes`** below; they contain advice/tips)

## Homographies Part I

**A) 07_Practical_Homographies\Part1\practical1.m**
Besides completing the TO DO's, make sure to describe and/or illustrate the first two TO DO's in the list of three: scale ambiguity and exact mapping of pairs of four points.

**B) 07_Practical_Homographies\Part1\practical1B.m**
Complete TO DOs and document in your report. You may use PracticalDataSm.mat instead of PracticalData.mat to go faster.

## Homographies Part II

**C) 07_Practical_Homographies\Part2\practical2.m**
Complete TO DOs and document in your report.

**D) 07_Practical_Homographies\Part2\ practical2b.m**
Complete TO DOs and document in your report. (hint: see Special Note above)

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## Condensation

(**Special Note**: There is an extra file in the zip, GetCelMaskPixels.m, which is needed if you want to play with the optional ExhaustiveTemplateSearchDemo.m. Also, there are some small differences between the code given in the lab practical #9, and the code used in G) below, so it is advisable to work in separate directories.)

**E) 09_PracticalCondensation\ Practical9a.m**

Complete TO DOs and document in your report.

**F) 09_PracticalCondensation\ Practical9b.m**

Complete TO DOs and document in your report. **Special Note**: You do NOT need to document the three TO DOs from the bottom of the intro (i.e. varying # of particles, modeling velocity in **w**, and visualizing the top-scoring particles). Though feel free to experiment with these.

## Combining Tracking and Homographies

G) **HW2\HW2_Practical9c.m**

Complete TO DOs and document in your report. **Special Note**: This task is mainly a repeat of F), so you can apply what you did (TO DOs) in 09_PracticalCondensation\ Practical9b.m, but note the differences.

- This function will be performed four times in the next part. But for now, you can run it by passing in 'll' as the templateMetaFileName argument.
- Also, the image sequence is now stored as grayscale, so the 3rd dimension has been dropped from the newly provided MeasurePatchSimilarityHere.m for you.
- Some other tips & advice have been provided as comments.

H) **HW2\HW2_TrackingAndHomographies.m**

Complete TO DOs and document in your report. Special Note: This task is mostly a repeat of D), so you can apply what you did (TO DOs) in 07_Practical_Homographies\Part2\ practical2b.m, but note the differences.

- Most importantly, consider this simplistic example, and mention at least two actions or changes we could make to improve the results (excluding actions from the Extra Credit).
- Other tips and advice have been provided as comments.

## Extra Credit

(extra points help you reach a perfect score for the two courseworks only, so a maximum of 20% of the overall grade).

- Reduce the search space where particles can land by using an edge-detector.
- Choose (or film!) a different video and/or 3D mesh, and augment the video as we did here.
- Each particle filter's state space **w** here was just the 2D image location of an interest point. Each interest point was tracked independently. Describe and if possible, attempt to make a particle filter whose **w** represents the state of an affine transformation of the whole pattern (black square on white paper). This will require modifying how new measurements are incorporated.