1. Implement a block motion estimator using full search and mean absolute distortion (MAD) criterion for block matching. Given the previous frame $P(x, y)$, for each $16 \times 16$ block in the current frame $C(x, y)$, find the motion vector $(dx, dy)$ such that

$$MAD = \frac{1}{256} \sum_{k=0}^{15} \sum_{l=0}^{15} |C(x + k, y + l) - P(x + dx + k, y + dy + l)|$$

is minimized. By convention, $(x, y)$ refers to the upper left corner of the block and displacements $(dx, dy)$ are positive when pointing to the right and down. You can limit the motion vector range to $[-15, 15]$. Be careful with blocks at frame boundaries. If there is a tie, always choose the motion vector with the smaller magnitude (i.e. $\sqrt{dx^2 + dy^2}$). Store the motion vectors in an ASCII file.

Test your motion estimation program on the frames 0-35 of the Glasgow sequence. Do the resulting motion vectors match the motion you observe from the sequence?

Write a Matlab function that reads the motion vectors and displays them as needle plots – one plot for every frame of motion vectors. Hint: check out the quiver function! Plot 30 needle plots for the first 30 frames of the Glasgow sequence. Examine your plots and comment on the object/camera motion in these frames. Try to use subplot to minimize the number of pages to be turned in.

Modify your algorithm to obtain half-pixel motion estimation accuracy. Again, use a full-search strategy. Compare the variance of the prediction error in both cases.

Due date: April 6 in class.