Motion Estimation — BMA

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Outline

- Optical Flow (Pixel-level)
  - What is optical flow?
  - Lucas-Kanade algorithm (LK) [2]
  - Horn-Schunck algorithm (HS) [3]

- BMA (Block-level)
  - The principle of BMA
  - Full search scheme
  - Three step search [4]
  - New three step search [5]
  - Four step search [6]
  - Diamond search scheme [7]

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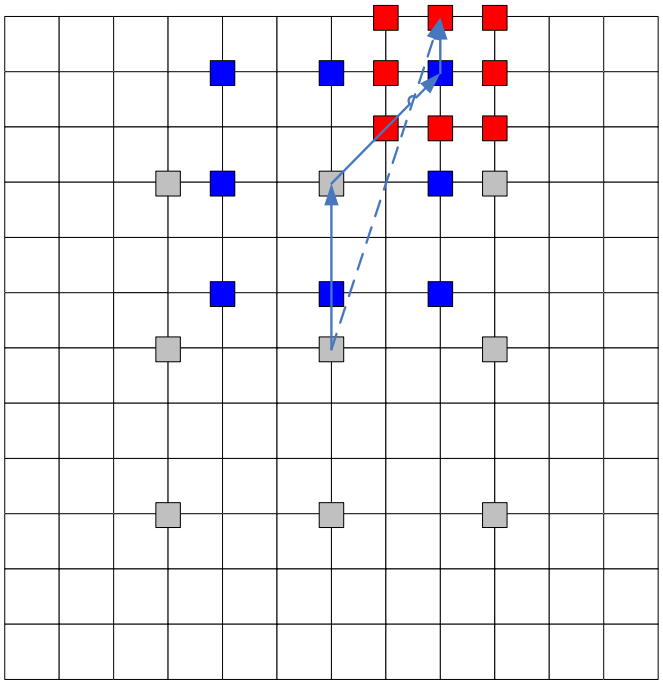
Three Step Search: TSS [4]

- For w=7, the matching points of TSS are 25, however the FS needs 225 comparisons.
- However, TSS uses a ***uniformly*** allocated search pattern in its first step, which is not very efficient to catch ***small*** motions appearing in stationary or quasi-stationary blocks.

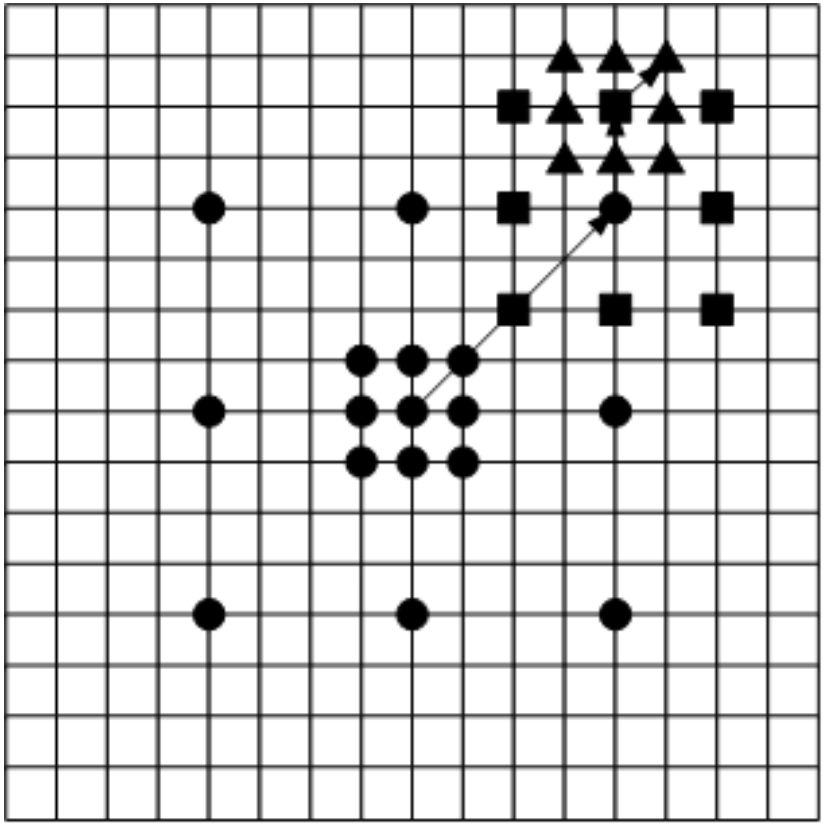


New TSS: NTSS [5]

- The TSS uses **a uniformly** allocated checking point pattern in its first step, which becomes *inefficient* for the estimation of **small** motions.
- The block motion field of a real world sequence is usually *gentle*, *smooth*, and *varies slowly*.
  - The global minimum motion distribution is **center-biased**, rather *uniformly* distributed.
- NTSS differs from TSS by
  - Assuming a **center-biased** checking point pattern
  - Incorporating a **halfway-stop** technique for stationary and quasi-stationary blocks.

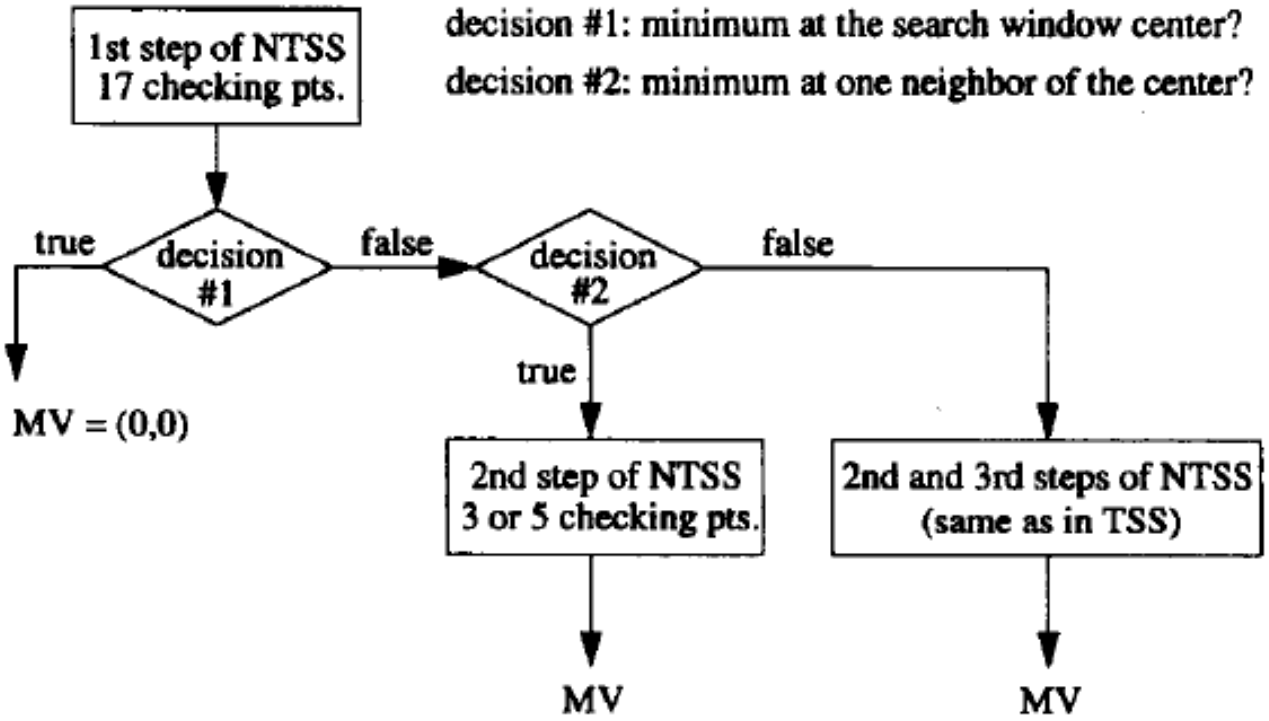
New TSS: NTSS [5]

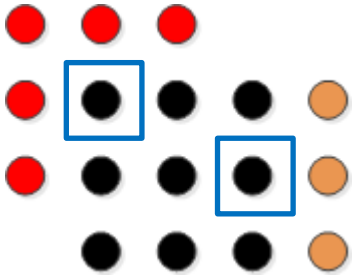
- In the first step, in addition to the original checking points used in TSS, **eight extra points** are added, which are the eight neighbors of the search window center.
- A halfway-stop technique is used:
  - **The first-step-stop**: if the minimum Block Distortion Measure (BDM) in the first step occurs at the search window center, stop the search.
  - **The second-step-stop**: if the minimum BDM point in the first step is one of the eight neighbors of the window center, the search in the second step will be performed only for eight neighbors of the minimum and then stop the search.



New TSS: NTSS [5]

- For the maximum motion displacement ±7, the NTSS **in the worst case** requires **33** block matches while TSS needs only **25** block matches.





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Thank You!

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