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BYE-94795-74
Cy 2 of 2 Cys
One Page Each

7 Aug 74

TO: SP-6/R. Jacobson

SUBJECT: Visual Edge Matching (VEM)

Dear Jake:

Attached you will find a memo from Joe Martin to me critiquing the application of VEM to the GAMBIT Program. Would it be possible for your personnel to review this memo and advise as to their viewpoint concerning VEM's application as an engineering technique for GAMBIT? I would like a one page or so response which I would propose to attach to [redacted] memo and forward to Lou Neuner in [redacted] and back to the SPPF as our overdue response to their enthusiastic embrace of VEM as a cornucopia for all photographic ills. (b)(3) (b)(1) (b)(3)

Thanks,

ORIGINAL SIGNED BY
L. W. ROBERTS

L. W. 'ROBERTS

1 Atch: Memo from [redacted] to L. Roberts, dated 1 Aug 74. (b)(3)

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Attachment #1

1 AUG 1974

[redacted] (b)(1) (b)(3)

Subject: Application of Visual Edge Matching (VEM) as an engineering analysis technique for Gambit.

To: [redacted] L. Roberts (b)(1) (b)(3)

Reference: AFSPPF Special Report No. 101-1-162 "Application Of Visual Edge Match".

1. Since its application to H, VEM has been suggested as an evaluation technique of great promise to the Gambit system. Certain claims have been made and conclusions reached by elements of the reconnaissance community which indicate VEM should be adopted by this office for engineering analysis. An evaluation of advantages and disadvantages to the VEM technique as applied to Gambit imagery is contained below.

A. Advantages:

(1) VEM is useable in the area of interest as well as the zone of the interior - the only requirement being the acquisition of naturally sharp edges.

(2) There is no requirement for the display of formal targets as with tribars and log periodic targets.

(3) A large sample size may be realized with VEM as opposed to acquisitions of formal displays.

B. Disadvantages:

(1) The choice of the edge to be evaluated by VEM is critical. The system will not work with edges that are not naturally sharp - this includes runway edges, many rooflines, etc. If an edge which is not perfectly sharp is evaluated, the VEM is in error by the amount the original edge was non perfect. This is more critical to a high resolution system rather than a search system.

(2) A completely valid calibration of VEM to resolution is not possible since the PPS/DR contractor has no capability like that of H for imaging lines, single pass, with an operational unit. This implies that the most promising use of VEM is focus assessment where a relative measure suffices. For this application VEM has been found in tests to be no better than the present technique of subjective evaluation of defocus records and is both more time consuming and costly in this application.

(3) The reconnaissance community is rapidly accepting the National Imagery Interpretability Rating Scale as an area of interest

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quality return measure. NIIRS has the advantages attributed to VEM above, plus the very significant advantage of being based upon real intelligence content as evaluated by the photointerpreter.

(4) Evaluation of system performance by VEM is impractical since the technique assigns all degradation to defocus. In fact smear and exposure can contribute equally with defocus to image degradation. Since the intent of engineering evaluation is to identify and correct for non optimum performance it would be difficult to rationalize a performance measure insensitive to all but one performance degrader.

(5) Factory-to-orbit correlation would be impossible with VEM since factory calibration is not practical. This correlation is valuable not only to ensure the system as flown had the same capability as expected from factory test, but also to ensure that operational resolution predictions are reasonable. The latter is especially important with Block II software where targets have specified resolution requirements.

(6) Preliminary results from Project Tricycle indicate that Gambit imagery is not overly dependent upon acutance (the measure of the apparent sharpness of an edge). This is also seen in operational photography where an apparently soft tribar image may yield a high resolution and an apparently sharp tribar may result in somewhat lower resolution. Acutance is the principle upon which VEM is based.

(7) A previous VEM report on Gambit applications (ref.) indicated that off axis performance was a promising area for VEM applications. Since the overiding image degrader is image/object motion mismatch (smear) and not field curvature (defocus), and VEM is noticeably insensitive to smear, this application is questionable.

(8) Another application suggested is investigation of DOL sensitivity (ref.). Currently there is no data to suggest that over normal DOL times experienced operationally there is a significant DOL dependence of focus. If, in reality, the effect exists it is well within the depth of focus of the system and would not be perceived by VEM analysis.

2. In summary, engineering evaluation applications of the VEM technique to Gambit missions do not seem to fill any voids in the present analysis, but only to complement present techniques. To be intelligently applied to Gambit, VEM should offer a significant improvement over present methods of evaluation - this does not appear to be the case. At present this system has numerous evaluation tools, some of which provide independent measures of the same parameter. The thrust in the immediate future is seen as an effort to perfect those evaluation techniques we have and eliminate redundancy where possible, not adopt another technique which offers no clear operational advantage.

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