

1. **Research Title:** "Accurate Prediction of Uncertainties in Computer Vision Algorithms"

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Electrical Engineering, Computer Science, Applied Mathematics (Computer Vision, Estimation & Fusion algorithms) -- MS or Ph.D. level

4. **Objectives:** To augment state-of-the-art computer vision algorithms with statistically valid models of the algorithms' output uncertainties. In particular, we are interested in statistically valid models for vision-aided navigation related algorithms (Simultaneous Localization and Mapping (SLAM), Structure from Motion, or Visual Odometry) and image matching algorithms. Tracking algorithms are also of interest, though of a secondary priority.

5. **Description:** Significant advances have been made in computer vision algorithms enabling vision-aided navigation (e.g., Simultaneous Localization and Mapping (SLAM) or Structure from Motion), image composition (e.g., stabilization or mosaicing), and tracking of objects. The majority of the efforts in these algorithms have been focused on improving the "best estimate" outputs of these algorithms, leading to significant improvements in the overall performance of these algorithms. Despite the increase in quality of the algorithms' outputs, it is difficult to use these algorithms in larger systems due to the lack of valid uncertainty information generated by each algorithm. For example, in vision-aided navigation, while the estimated end location after maneuvering a robot over several kilometers has become dramatically more accurate over the past decade, how accurate this estimate actually is either unknown or estimated by running the algorithm on several different runs of the robot. The focus of this project is to modify computer vision algorithms such that they generate their own statistically valid estimates of uncertainty in addition to the "best estimate" outputs that they currently generate.

6. **Research Classification/Restrictions:** *None*

7. **Eligible Research Institutions:** Place an X in all that apply.

Universities (DAGSI) AFIT (only) USAFA

8. **Interest in Summer USAFA Cadet (Avg Cost for USAF Cadet for 33 days was \$5000):**

I would be interested in sponsoring a cadet in summer 2013.