DAGSI Research Topic

1. **Research Title:** Conditional Confidence Calibration

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Electrical Engineering, Computer Engineering, Computer Science, Statistics, Mathematics (MS or PhD level)

4. **Objectives:** Explore various notions of conditional confidence calibration for deep neural networks, and their impact on sensor fusion **effectiveness**, **robustness** to distribution shift, and the **amount and diversity** of calibration data required to achieve effective calibration.

5. **Description:** While deep learning can be highly effective for classification of high dimensional data, neural networks are prone to overconfidence. Probabilistic calibration of these classifiers is essential to enable fusion of classifiers from multiple sensors (which may provide competing information that must be arbitrated) and to build trust with the end user. One common notion of calibration requires that on average the confidence reported by the model equals the probability of correct classification (e.g. see https://arxiv.org/abs/1706.04599). However, stronger notions of confidence calibration can be achieved by conditioning on additional information, such as the predicted class label (see Gupta's top-label calibration in https://arxiv.org/abs/2107.08353), or perhaps by conditioning on other known or inferred metadata such as operating condition (e.g. observation angle). These alternative notions of calibration could provide stronger information to support fusion and potentially be more robust to distribution shift between calibration and test data, but could also require more data to achieve reasonable calibration with low variance.

6. **Research Classification/Restrictions:** Unclassified.

7. **Eligible Research Institutions:** DAGSI Universities