# Camera Calibration in Computer Vision

**Luis Avila, Dr. Dezhen Song, Joseph Lee**
**Research Experiences for Teachers Program (Summer 2014)**
**Department of Engineering Technology & Industrial Distribution Department,**
**Texas A&M University**

Images are a good way to capture a scene, relay a message, or leave a lasting impression of a symbol, logo, or clip art. With the high volumes of visual data and the need for a quick and accurate interpretation of the data in both the private and public sector have caused engineers to explore methods of image understanding. Computer Vision is the discipline that studies how to reconstruct, interpret, and understand a 3D scene from its 2D images in terms of the properties of the structures presented in the scene. It combines the knowledge in computer science, electrical engineering, mathematics, and biological sciences among others disciplines. It is difficult to establish a clear division between computer vision and image processing. A paradigm to be considered is the type of computerized processing involve. Image processing types includes low, mid, high level. Current applications in Computer Vision include hazard detection and avoidance, 3D imaging technologies, automated surveillance, gesture recognition, and gaming. At the heart of each field above lies the use of homogeneous coordinates and matrix mathematics to store, process, and generate meaningful outputs. Linear transformation of Euclidean space $R^n$ is accomplished by matrix multiplication of a transformation matrix and point coordinates. The Euclidean space $R^n$ can be extended to a projective space $P^n$ by representing points as homogeneous vectors. Projective transformation is applied by multiplying a coordinate vector by a non-singular matrix. The use of projective geometry along with camera calibration is used, in many instances, to reconstruct 3D scenes from 2D images.