ECE 417/598: What did we learn?

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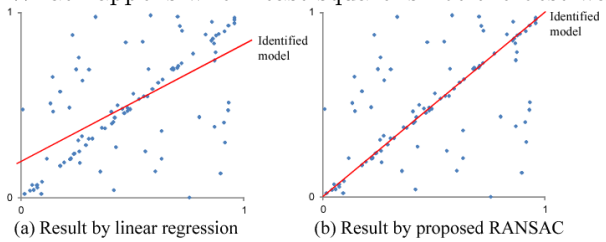
Things to take away from this course

1. Converting 3D vision problems to a system of linear equations.
2. Converting system of linear equations to the form $A\mathbf{x} = b$ or $A\mathbf{y} = 0$ form and solving them in the least square sense.
   (a) The solution $\mathbf{x} = A^{\dagger}\mathbf{b}$ minimizes $\min_{\mathbf{x}} \|A\mathbf{x} - \mathbf{b}\|^2$.
   (b) The SVD based solution $\mathbf{y} = \lambda_{r+1}\mathbf{v}_{r+1} + \cdots + \lambda_n\mathbf{v}_n$, if $A = U\Sigma V^{\top}$ is the SVD of A, minimizes $\min_{\mathbf{y}} \|A\mathbf{y}\|^2$ such that $\|\mathbf{y}\| = 1$.
3. Pinhole camera model, $\mathbf{u} = \lambda K\mathbf{X}$ or equivalently $\mathbf{X} = \lambda K^{-1}\mathbf{u}$.
4. Geometry problems like line-plane intersection, plane-plane intersection and line-line intersection.
5. Finding Homography H, Projection matrix P, camera matrix K from correspondence points.

Limitations of this course This course has focused mostly on linear equations and their least-square solutions.

1. What to do when the equations are not linear? Can you covert non-linear equations into approximate linear equations?

2. What happens when least-square is not the best way to handle noise?



(a) Result by linear regression (b) Result by proposed RANSAC

3. How to automatically find correspondence points?

Some questions on the ECE 598 paper `./Zhang.pdf`