

ECS130

Linear Systems and
the LU Decomposition

January 11, 2019

Chapter 3: Linear systems

$$Ax = b,$$

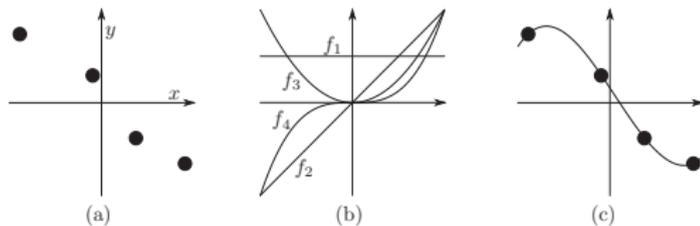
where $A \in \mathbb{R}^{m \times n}$, $x \in \mathbb{R}^n$ (unknown), and $b \in \mathbb{R}^m$.

Applications (section 4.1):

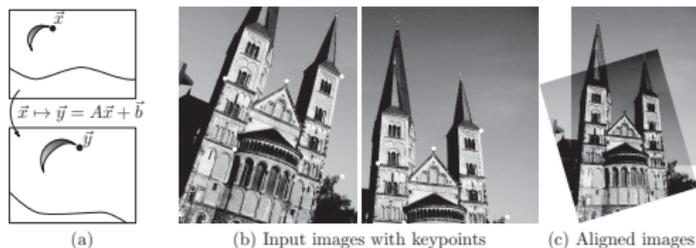
- ▶ least squares
data fitting, regression
- ▶ Tikhonov regularization
image alignment, deconvolution

Applications

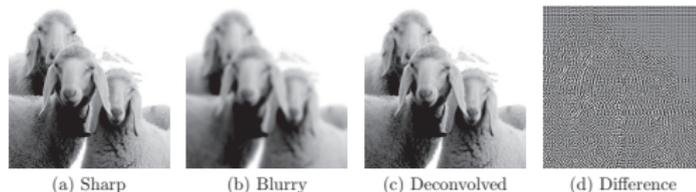
► Data fitting



► Image alignment



► Deconvolution



Outline of Chapter 3

1. Solvability of linear systems
2. Elementary matrix operations
 - ▶ permutation
 - ▶ row scaling
 - ▶ elimination
3. Gaussian elimination
 - ▶ Forward-elimination/substitution
 - ▶ Back-elimination/substitution
4. LU factorization
5. The need of pivoting – mathematically
6. *The need of pivoting – numerically**

* to be discussed after covering Chapter 2.