Psycho-visual modulation based information display: introduction and survey

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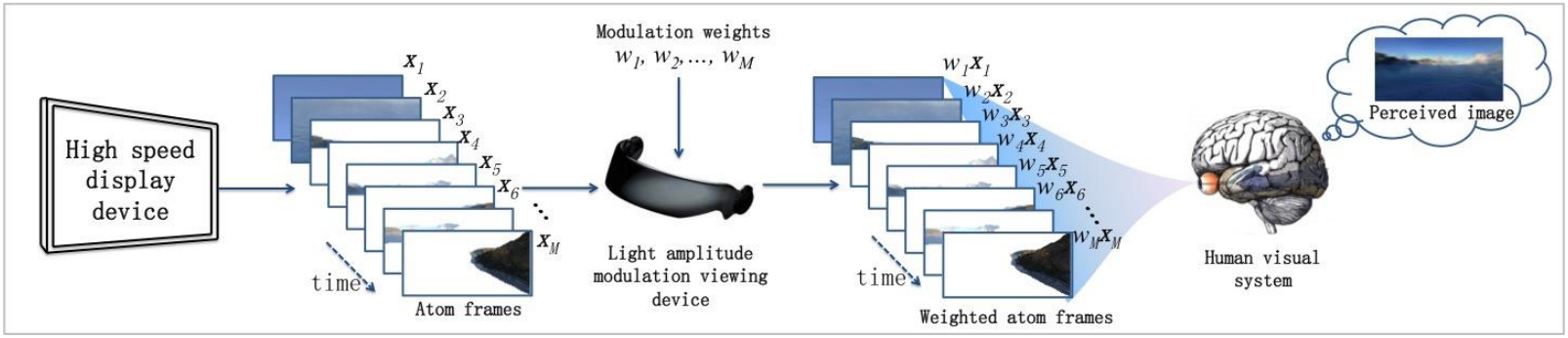
Motivations

- A modern high-speed display device (LCD, LED, DLP and etc.) can emit in visible spectrum a far greater amount of information than one person can possibly resolve.
- Possibility to serve multiple viewer on a single display.
- But how?



- Our solution: Psycho-Visual Modulation based display technique !
- Can be solved via constrained non-negative matrix factorization:

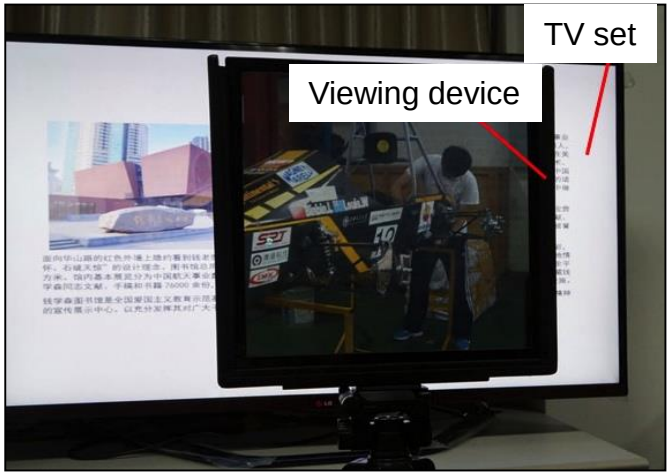
$$\min_{\mathbf{X},\mathbf{W}} \| \mathbf{Y} - \mathbf{X}\mathbf{W} \|_F^2, \quad \text{subject to} \quad 0 \le \mathbf{X}, \mathbf{W} \le 1,$$

$$\Rightarrow \min_{\mathbf{X},\mathbf{W}} \left(\| \mathbf{Y} - \mathbf{X}\mathbf{W} \|_F^2 + \lambda_1 \| \mathbf{y}_0 - \mathbf{X}\mathbf{1} \|_F^2 \right), \quad \text{subject to} \quad 0 \le \mathbf{X}, \mathbf{W} \le 1,$$

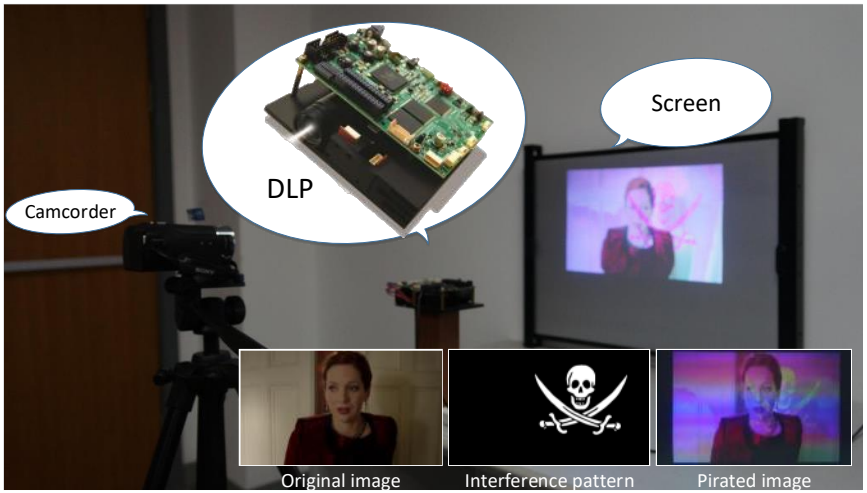
$$\Rightarrow \min_{\mathbf{X},\mathbf{W}} \left(\| \mathbf{Y} - \mathbf{X}\mathbf{W} \|_F^2 + \lambda_1 \| \mathbf{y}_0 - \mathbf{X}\mathbf{1} \|_F^2 + \lambda_2 \sum_{k=1}^{K} \| \mathbf{w}_k \|_{\ell_1} \right), \quad \text{subject to} \quad 0 \le \mathbf{X}, \mathbf{W} \le 1,$$

Results and Applications

Duel-view TV (two views at a time)



Anti-piracy display (pirated video with watermarking)



2D-3D compatible display (3D and 2D viewed at the same time, yet without gosting)