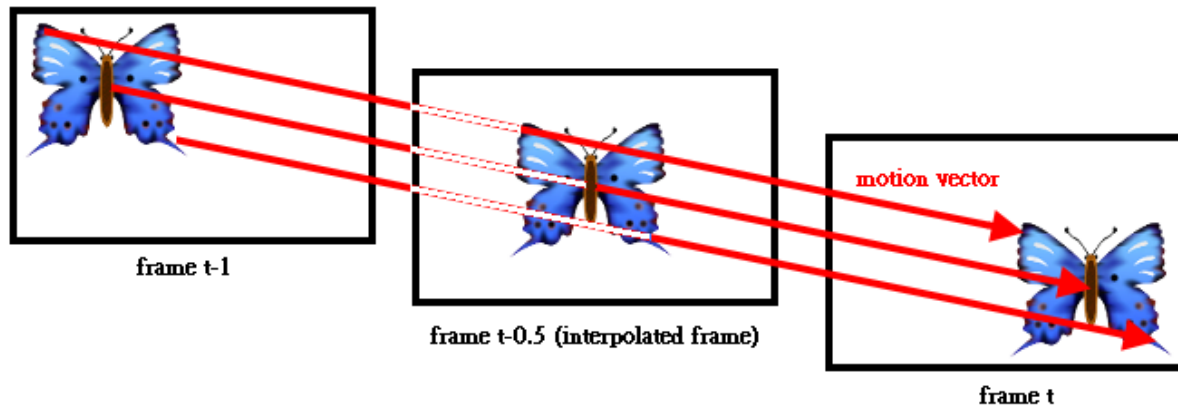# Introduction
Background

- Frame Rate Up-conversion (FRUC)
  - Convert frame rate of video sequence to higher

  frame t-1

  frame t-0.5 (interpolated frame)

  motion vector

  frame t

  - The purpose
    - Data compression (at decoder side)
      - With known interpolated-frame
    - Hold-type motion blur reduction on LCD
      - Without known interpolated-frame

Introduction
Background

- Hold-type motion blur evaluation
  - Direct method
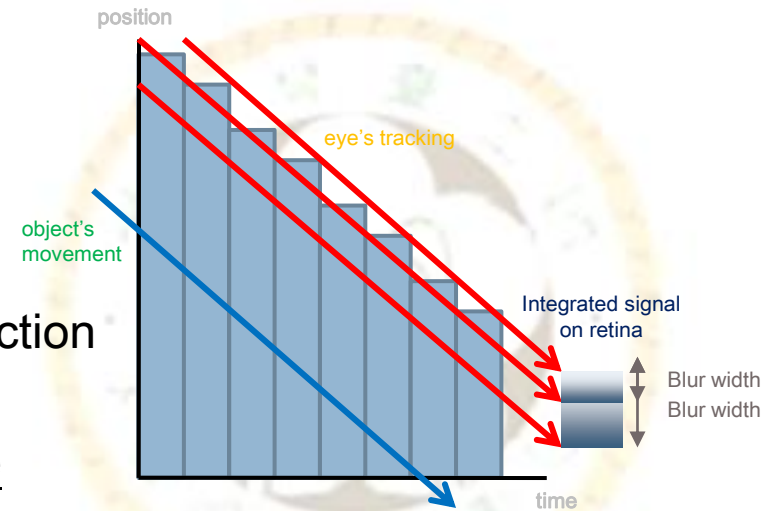   - Blur width = velocity / frame rate
  - Theoretical method
    - Based on the sampling and reconstruction theory [Sharp Labs 05]
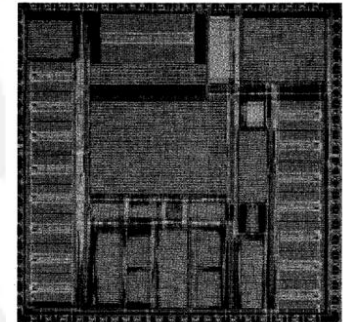   - Blur width = 0.8 x velocity / frame rate
  - FRUC **exactly** reduces hold-type motion blur

- Real-time FRUC chip
  - First appeared in ICCE 1995, as a commercial product [Philips Semiconductors 95]
  - Lack of academic literature or announcement

[Sharp Labs 05]
Hao Pan, Xiao-Fan Feng, and Scott Daly, Sharp Labs of America, "LCD Motion Blur Modeling and Analysis," ICIP 2005

[Philips Semiconductors 95]
G. de Haan, J. Kettenis and B. de Loore, Philips Semiconductors, Eindhoven, The Netherlands, "IC for Motion-Compensated 100 Hz TV with Smooth-Motion Movie-mode," ICCE 1995

Introduction
Design Motivation & Target

- Motivation
  - FRUC algorithm & architecture design for motion blur reduction on LCD
- Target
  - Low computation cost
  - Multi rate up-conversion
    - 24 Hz to 120 Hz
    - 60 Hz to 120 Hz
  - Supporting next LCD generation's resolution
    - Quad HD = 3840x2160
  - Reasonable bandwidth consumption
    - Can work on real LCD system
  - Low area cost
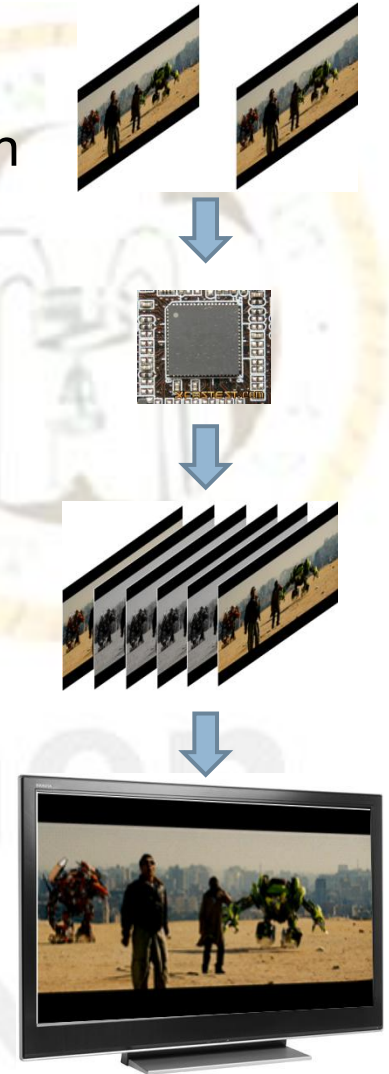
Introduction
Design Motivation & Target

- Target
  - For variety of videos
    - We choose many types of test sequences, including sport game lives & movies
    - No real Quad HD sequence, so we use **1920x1080 (1080p)** sequence instead for experiment.