High resolution consumer camcorders are widely used

Various kinds of noise are included in video taken by camcorders

- It is difficult to separate each noise from resulted video, since the current camcorder system is complex, achieving high performance with compact body
Objectives

- In development of consumer camcorders, noise is evaluated subjectively by video quality specialists using prototypes
  - This scheme requires much man-hours and limits the turn around time
- An efficient noise evaluation scheme is high required
  - Noise evaluation scheme for consumer camcorders
  - Real-time noise evaluation systems
  - Noise characteristics for each camcorder mode is investigated
  - Detailed evaluation of noise in camcorders is carried out, which includes evaluation of temporal change of noise
Overview of noise evaluation

- Environment of noise evaluation
  - Video sequences taken in completely dark room are used
  - Six camcorders are used in this experiment
    - Totally 34 pattern video sequences are used, since there several recording option for each

- Noise evaluation method
  - Difference of noise among models and settings are evaluated
    - Fixed pattern noise is used for this evaluation
  - Metrics of noise evaluation for still cameras can be used
    - When we evaluate noise in video sequence, we have to pay attention to not only spatial noise component but also temporal component
**Detail of noise evaluation**

- **Evaluation method**
  - Utilizing the following data
    - **Average frame**
      - Random noise is suppressed, and pattern noise is emphasized
    - **RMS granularity**
      - See the noise strength and temporal change of noise
  - One frame data
  - Line data
    - \((f(x), g(y), h(t)); \text{ given by the right equations}\)
  - Dark frame data used in flat fielding

- **Noise Evaluation**
  \[ I'(x, y) = \sum_{t=0}^{T} I(x, y, t) \]

- **One frame**
  \[ I_t(x, y) \]

- **Line data**
  \[ f(x) = \sum_{y=0}^{H} I'(x, y) \]
  \[ g(y) = \sum_{x=0}^{W} I'(x, y) \]

- **Dark frame data**
  \[ h(t) = E[I_t(x, y)] \]

\[ I''(x, y) = \text{Med} \left( I_0(x, y), I_1(x, y), \ldots, I_T(x, y) \right) \]