Research Masters in Computer Vision, Image Processing, Graphics and Simulation

Physics, Psychophysics and Physiology of Vision

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Physics of Vision: Contents

Lecture 1: Imaging, digital video, algorithms and processors

- **solid state camera**
  - sensing, video standards & sampling
  - composite video and data rate
  - colour
- **analogue and digital video**
  - digital acquisition & digital video
  - computer requirements
  - processor performance data
- **algorithm requirements: examples**
  - smoothing
  - detection, location & tracking
  - template matching
- **processors**
  - range of devices
  - architecture & performance
  - CISC, RISC and DSP
- **multiprocessor systems**
  - pipeline and parallel systems
  - parallel architectures
  - processor farms

Lecture 2: Image modelling

- **introduction**
  - modelling in computer vision
  - the information in an image, entropy measures
  - clutter, scale and texture
- **effective image modelling**
  - the image ensemble
  - idealised imaging (see notes by TJE and VIGR seminar MV notes)
  - colour representations
- **modelling image structures**
  - parametric and non-parametric statistical models
  - the image intensity
  - parameter estimation, maximum likelihood
- **modelling correlations**
  - natural images,
  - power spectra and scaling of temporal and spatial correlations
  - random fractal images, examples
- **Markov random field models**
  - Gibbs potential, neighbourhood interactions and cliques
  - generation of Markov random fields
  - relaxation (details of simulated annealing not for examination)
- **Adding noise: image restoration**
  - MAP (maximum a posteriori) estimation and regularisation
  - examples: nearest neighbour and next nearest neighbour interactions
  - hidden variables: edge processes
- **Parameter estimation, model selection and segmentation**
  - partition function: why maximum likelihood is difficult
  - hierarchy of models: parsimony
  - segmentation, unsupervised training and mention of EM algorithm