

Vision Intelligence V: Applications

Wei Qi Yan

Auckland University of Technology

Table of Contents

1 Intelligent Surveillance

2 Intelligent Navigation

3 Other Applications

Vision Applications

- **Visual Information Retrieval:** Annotations (tags or labels) related, features, relevance feedback, etc.
- **Face Detection and Recognition:** Pattern classification and recognition, etc.
- **Visual Event Computations:** Event manipulations, clustering, classification, etc.
- **Intelligent Surveillance:** Sensors, monitoring, alarming, etc.
- **Intelligent Navigation:** Photo-based, GPS-based, etc.
- **Others:** Autonomous vehicles, etc.

Intelligent Surveillance

- Surveillance is being increasingly used for traditional and non-traditional security applications.
- The decreasing costs coupled with rapid miniaturization of video cameras have enabled its widespread use at anywhere.
- The trend of coupling video cameras to cell-phones will only accelerate this trend.
- Surveillance is moving away from mere data collection with manual observation to intelligent analysis of events and actions at a semantic level without the intervention of humans.

An Intelligent Surveillance System

- 1G: Analogue CCTV System
 - ① Analogue technology
 - ② Image distribution and storage in analogue technologies
 - ③ D/A conversions
- 2G: Surveillance + Vision
 - ① Event detection, object tracking and behaviour analysis
 - ② Machine learning, understanding, semantic interpretations
- 3G: Automated Multimodal System
 - ① Distribution systems (integration, communication)
 - ② Multi-sensor platforms
 - ③ Data fusion and reasoning

Intelligent Surveillance

- Sensor deployment and management
 - Media capturing, compression, and secure transmission
 - Media semantic analysis and understanding
 - Object tracking and event detection
 - Decision making for alarms (fire, smoking, ...)
 - Event database and exploration
 - Event search and retrieval, mining and reasoning
 - Event presentation using web / mobile
 - System secure access and data protection
 - Ethical / privacy issues in surveillance system
 - Supercomputing (FPGA/GPU) and cloud computing
 - Big data analysis and deep learning

Vision Intelligence: Surveillance

An Intelligent Surveillance System (Demo)

Event Web Based System

LOGIN MONITORS SENSORS EVENTS ALARMS LOGOUT

Log In

User Name:

Password: 

Remember me next time.

Log In

Copyright@2012 -AUT Event WebSite

Vision Intelligence: Surveillance

Camera Deployment and Monitoring(Demo)

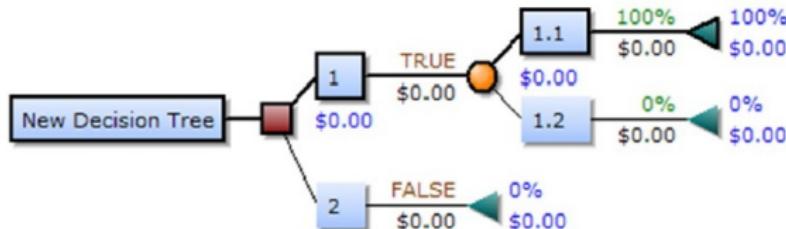


Alarm Making

- Rule-based alarms (IF<conditions>THEN<Actions>END)
- Probability-based alarms (expectations, risks, errors, etc)
- System-based alarms (event driven alarms)

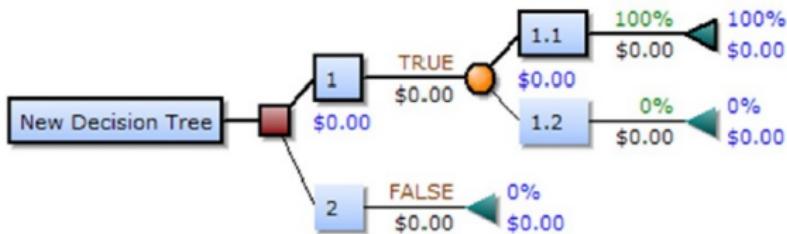
Alarm Making: Decision Tree

- *Strategy:* Split the records based on the attribute test that optimizes certain criterion.
- *Issues:*
 - ① Determine how to split the records.
 - ② How to specify the attribute test condition?
 - ③ How to determine the best split?
 - ④ Decide when to stop splitting



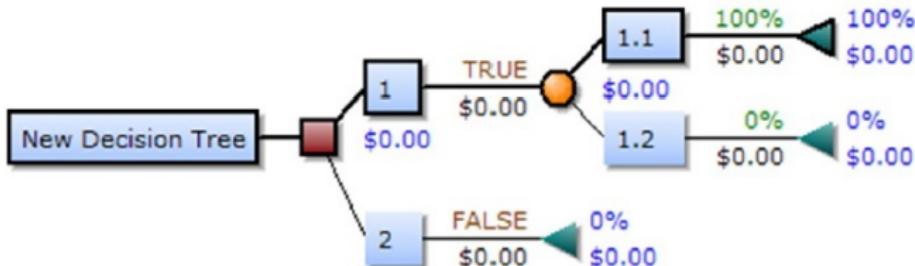
Alarm Making: Decision Tree Nodes

- ① *Decision nodes:* Squares
- ② *Chance nodes:* Circles
- ③ *End nodes:* Triangles



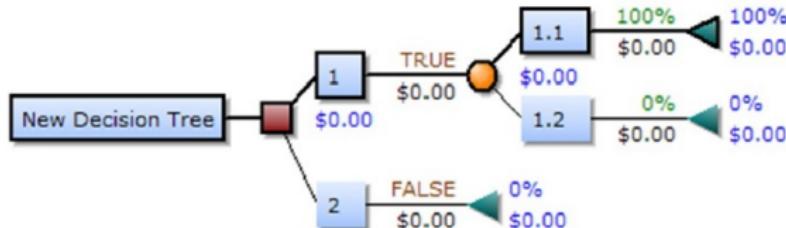
Alarm Making: Decision Splits

- ➊ *Multiway split*: Use as many partitions as distinct values.
- ➋ *Binary split*: Divide values into two subsets.
- ➌ *Optimal partitioning*



Alarm Making: Stop Conditions

- ① Stop expanding a node when all the records belong to the same class.
- ② Stop expanding a node when all the records have similar attribute values.



Vision Intelligence: Surveillance

Questions?



Questions?

In decision tree, which nodes are represented by using squares:

- 1** Decision nodes
- 2** Chance nodes
- 3** End nodes
- 4** None of the given options

The correct answer is:___

Vision Intelligence: Surveillance

Questions?



Vision Intelligence: Navigation

Intelligent Navigation

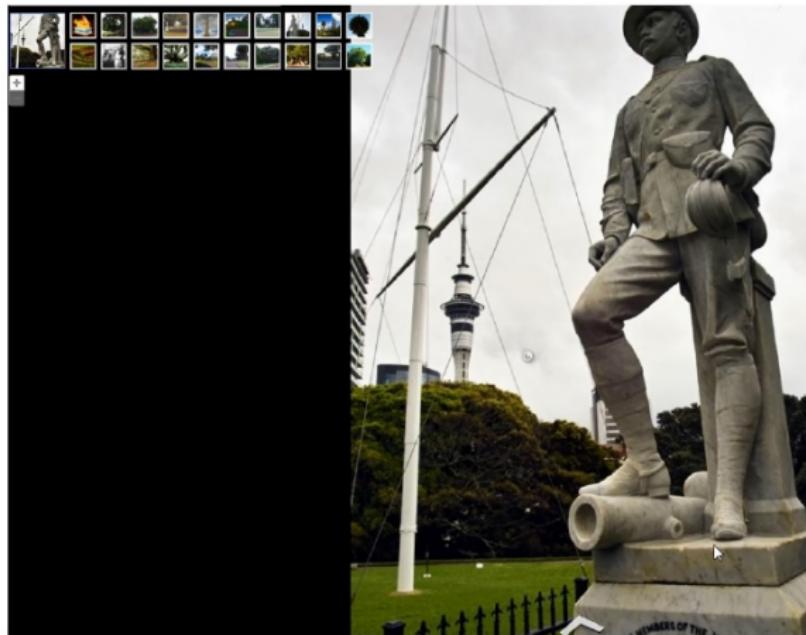
Google Street View



Vision Intelligence: Navigation

Intelligent Navigation

Google Photographs



Vision Intelligence: Navigation

Intelligent Navigation

The AUT Navigation System (Demo)

Get floor map



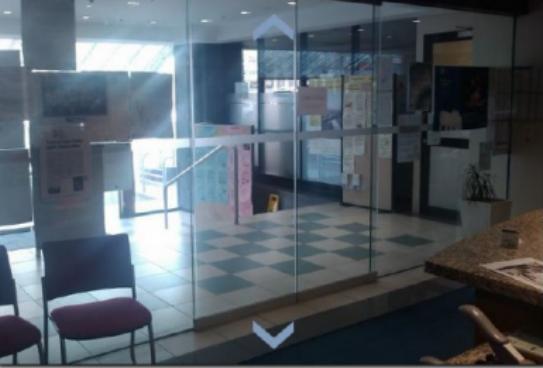
Search results

- [No.1 path to kitchen](#)
- [No.2 path to kitchen](#)

Upload your images

kitchen

Get info



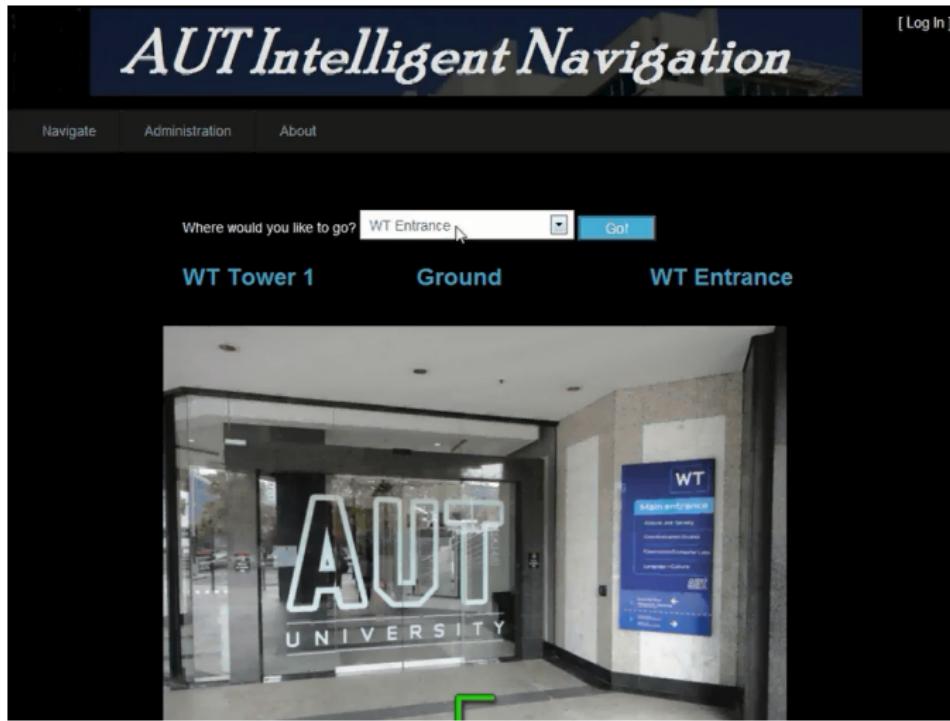
< >

Uploaded your images

Vision Intelligence: Navigation

Intelligent Navigation

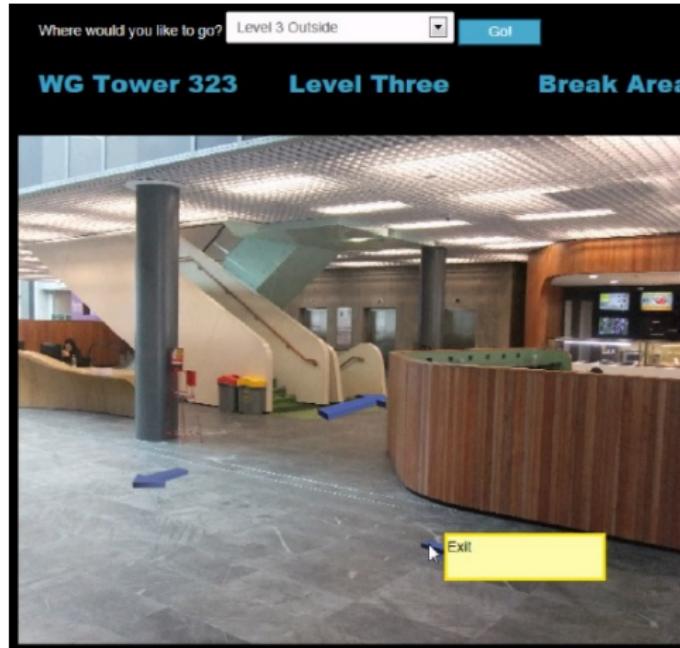
AUT Navigation System: WT Building (Demo)



Vision Intelligence: Navigation

Intelligent Navigation

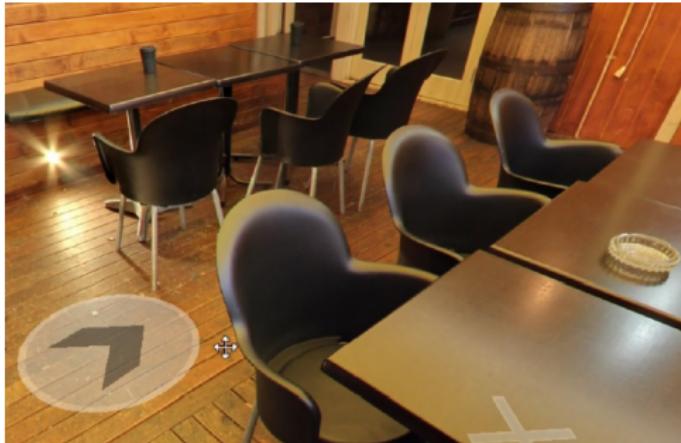
AUT Navigation System: WG Building (Demo)



Vision Intelligence: Navigation

Intelligent Navigation

Google Street View (Demo)



Vision Intelligence: Navigation

Intelligent Navigation

Google 3D Properties: AUT Tower (WT)



Vision Intelligence: Navigation

Intelligent Navigation

Google Underwater



Vision Intelligence: Navigation

Questions?



Vision Intelligence: Other Applications

MATLAB: OCR and Text Recognition



Automatically Detect and Recognize Text in Natural Images

Detect regions in an image that contain text. This is a common task performed on unstructured scenes. Unstructured scenes are images



Recognize Text Using Optical Character Recognition (OCR)

Use the `ocr` function from the Computer Vision Toolbox™ to perform Optical Character Recognition.

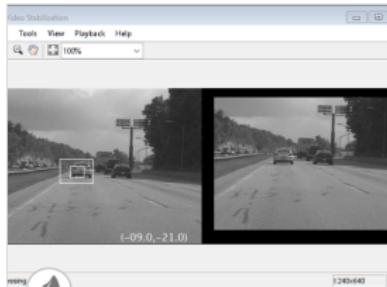
Vision Intelligence: Other Applications

MATLAB: Car and Stability Detection



Detecting Cars Using Gaussian Mixture Models

Detect and count cars in a video sequence using foreground detector based on Gaussian mixture models (GMMs).

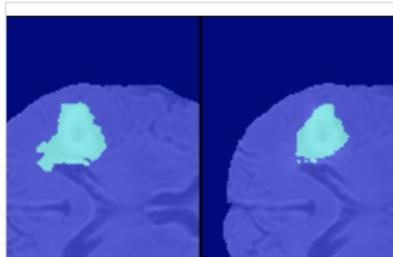


Video Stabilization

Remove the effect of camera motion from a video stream.

Vision Intelligence: Other Applications

MATLAB: Tumor and Barcode Detection



3-D Brain Tumor Segmentation Using Deep Learning

Train a 3-D U-Net neural network and perform semantic segmentation of brain tumors from 3-D medical images.



Barcode Recognition

Create an image processing system which can recognize and interpret a GTIN-13 barcode. The GTIN-13 barcode, formally known as EAN-13,

Vision Intelligence: Other Applications

Questions?



Learning Objectives

- Demonstrate advanced understanding of the state-of-the-art in the practice of vision intelligence.
- Demonstrate knowledge of how to design and implement an AI system using AI based visual models.