



ICT for food security an application for rice in ASEAN countries



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Rice in Asean



- In the world:
 - ◆ Asia produces **90% of the world's rice supply** [1]
 - ◆ Thailand, Vietnam: **largest rice producer & exporter**
 - ◆ Indonesia, Philippines: **largest rice consumers & importers**
- 2009: ASEAN leaders adopted the **ASEAN Integrated Food Security** (AIFS) framework.
 - ◆ An integrated food security information system
 - ◆ Agricultural innovation



Open issues

- **NOT YET an integrated system based on ICT for managing rice/rice seed**



- **NOT YET ICT platform for researcher collaboration**

- ◆ At different stages of rice/rice seed production
- ◆ Limited knowledge & information sharing (in the same country)

- **LACK of ICT & computer vision tool for rice/rice seed quality assessment**

- ◆ Rice/rice seed quality assessment is done manually (naked eyes)

- **Research at molecular/gene level is still limited.**

- ◆ Lack of experts in Bioinformatics for rice
- ◆ Lack of computational resources.



Objectives

- **A collaborative information system for rice/rice seed in ASEAN countries**
 - ◆ Rice varieties
 - ◆ Rice weed
 - ◆ etc.
 - ◆ Diseases
 - ◆ Rice genomics
- **Non-destructive methods** in different steps of rice/rice seed production process by relying on **computer vision, photometry & machine learning techniques**
 - ◆ Weed detection & suppression
 - ◆ Early disease detection from rice leaf
 - ◆ Rice/rice seed quality inspection & analysis
- **Storage solution** as well as **mining algorithm** in order to **exploit rice's genome sequence** information



Our recent research for rice in Vietnam

Assessment of rice seed samples

- Rice seed assessment is done manually by naked eyes of experts/technicians
 - ◆ It's **laborious**, **time consuming** & **inefficient**
 - ◆ Cause **degrade** in **seed quality** & **losses** in the **productivity**



Seed classification & testing based on visual appearances

- Automating this process:
 - ◆ Using **computer-aided machine vision system**
 - ◆ **IT technology**

Our recent research for rice in Vietnam

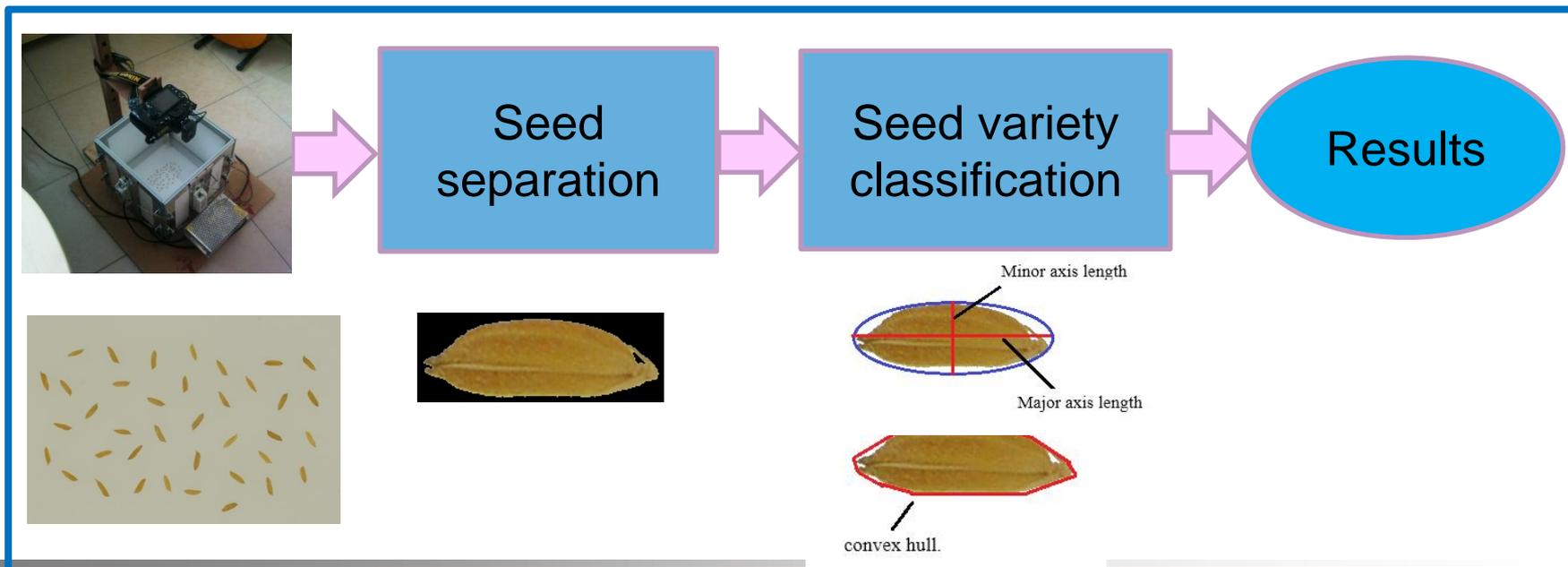
Assessment of rice seed samples



■ CUI (Belgium) project (2014-2015)

- ◆ Vietnam National University of Agriculture (VNUA)
- ◆ MICA, Hanoi University of Science and Technology
- ◆ Thai Binh Seeds Corporation (TSC)

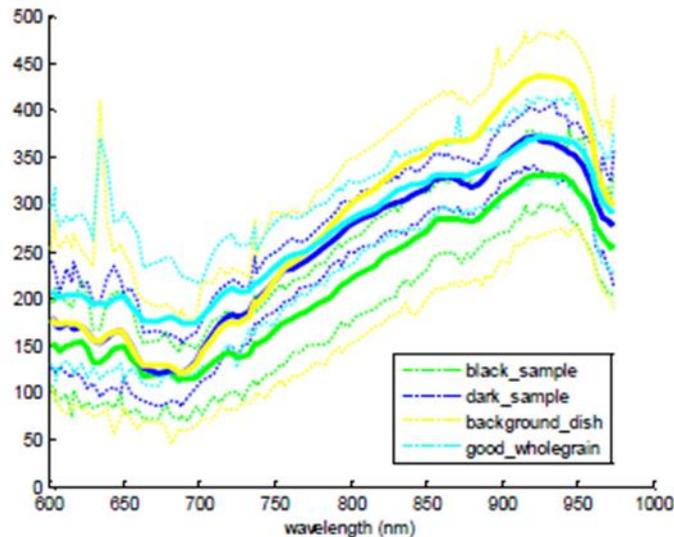
➔ Vision-based for rice seed classification



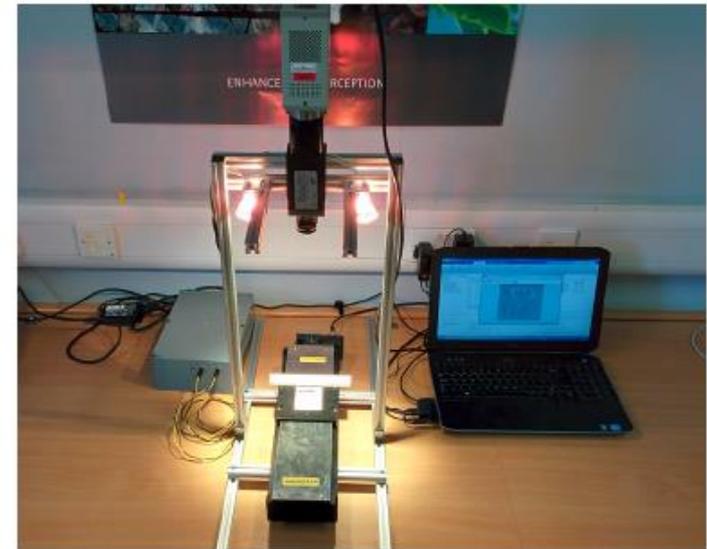
Our recent research for rice in Vietnam

Rice seed inspection using Hyper Spectral Imaging

- **NEWTON fund project:** MICA & Uni. of Strathclyde
 - ◆ **Analyze & extract features from spectral responses** at various wavelengths.
 - ◆ HSI offers **higher predictions of analyses:** detecting abnormal seeds, rice seed classification.



Training set HyperSpectral signatures

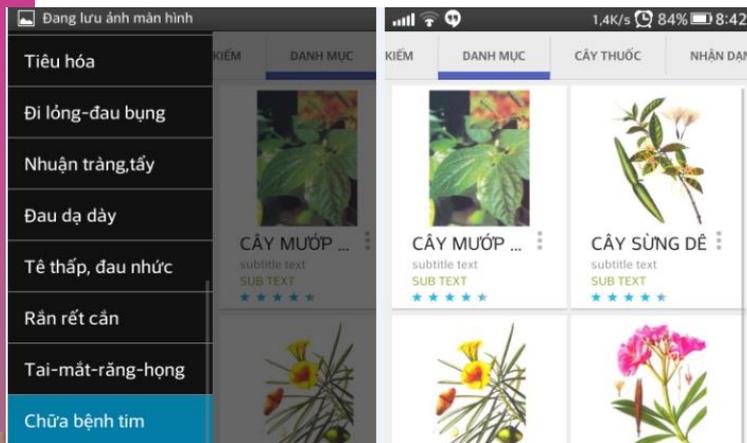
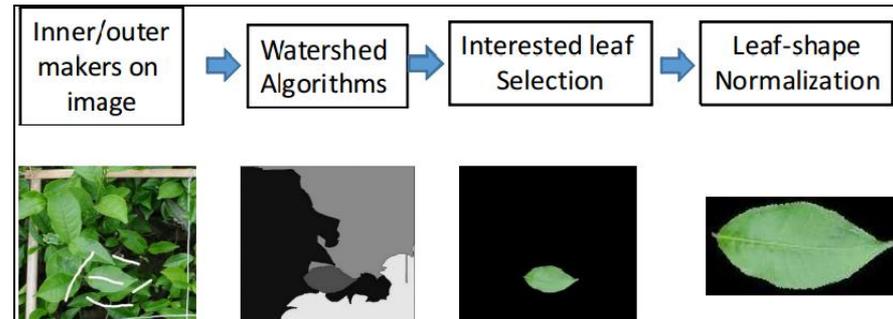


A Hyper Spectral Imaging system

Our related research

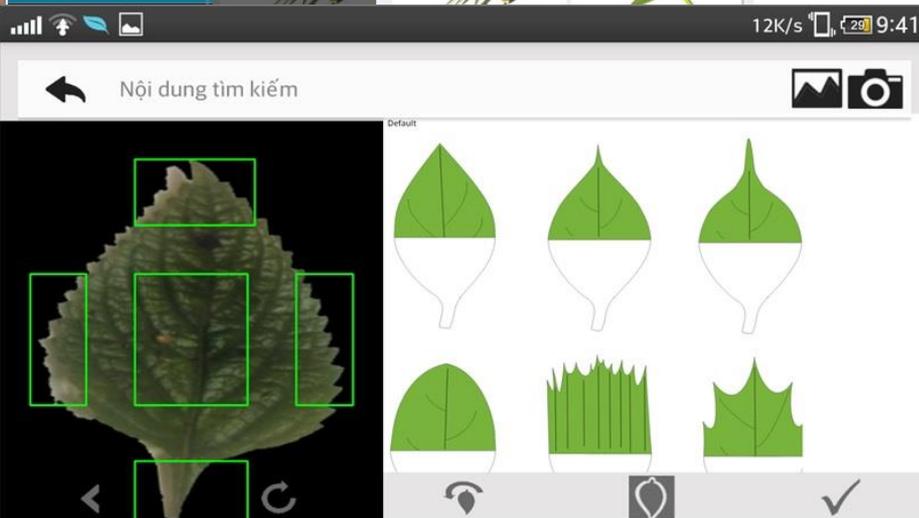
Plant identification and retrieval

■ Leaf content analysis for plant identification



■ Vietnamese medicinal plant retrieval application

- ◆ **600 medicinal plants**
- ◆ **Search with different modes**
 - ★ Keyword
 - ★ Image
 - ★ Botanical description: shape, edge, stem, vein,



Our related research

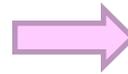
Automatizing tea-shoot detection

- **CUI project (2011-2013)**

- ◆ Counting tea-shoots to make a tea harvesting decision
- ◆ It takes time and tedious task



Captured image



Tea-flush positions

- **Objective:**

- ◆ Automatically detecting and counting the tea-shoots

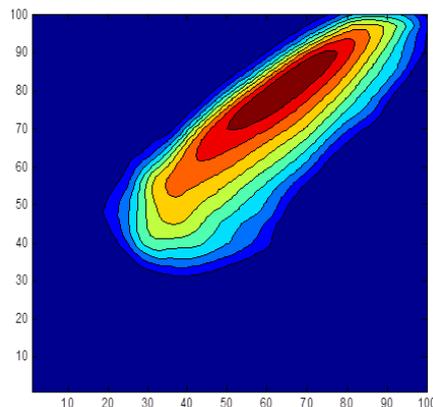
Related research in MICA

Automatizing tea-shoot detection

- Learning color model of tea-shoots images



Tea flush images



Color model of tea-flush



Candidates of tea-flush

- Extracting local features



Extracted regions



Detected ROI
(Zoom-in)



Edge detections



High-density
Edges

Recent research for rice in Vietnam

- UK's TGAC has worked with the Vietnam Agricultural Genetics Institute to explore the **genetic diversity of Vietnamese rice/rice seed**:
 - ◆ sequencing of 36 rice varieties
 - ◆ 48 rice accessions will be added
- Genome sequencing of rice varieties **will supply researchers the information at molecular level**
 - ◆ Academic researches
 - ◆ Applied researches.

TGAC 
The Genome Analysis Centre™



Call for collaborations

■ Collaborative information system

- ◆ Build an information system:
 - ★ Managing and sharing the rice/rice seeds characteristics
 - ★ Sharing rice/rice seed information from each country

■ Non-destructive methods

- ◆ Osaka University
- ◆ King Mongkut's Institute of Technology Ladkrabang



■ Rice's genome sequencing

- ◆ Genome Institute, BIOTEC, Thailand
- ◆ Vietnam National University of Agriculture
- ◆ Crops Research and Development Institute, Vietnam



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Thank you for your attention !

