Offline 1000-Class Classification on a Smartphone

Yoshiyuki Kawano and Keiji Yanai
Department of Informatics,
The University of Electro-Communications,
Tokyo, JAPAN

The University of Electro-Communications

Background

- **Rapid progress of smartphone**
  - **Obtain enough computational power for image recognition.**
  - **But, rapid mobile recognition is still a challenging task.**

- **Large-scale object recognition**
  - **1000 class (ex. ILSVRC)**
  - **More practical system**
  - **But, smartphone's memory is limited**

Objective

Mobile Recognition System

- recognize many kinds of object

- require **no communication** with a server
  - Recognition on a smartphone

- Offline recognition system
  - **Real-time** image recognition

Offline vs. Online

- **Advantage** 🙂
  - ○ **Able to use anywhere**
  - ○ **real-time recognition**
    thanks to no communication overhead
  - ○ **Not required the server**

- **Disadvantage** 🙁
  - ✕ **computational power and memory size**
  - ✕ **electricity consumption**

Related Work

- **Google Goggles**
  - **Specific object Rec**
  - **Similar image search**
  - **OCR**

- **Leaf snap (Kumar et al, ECCV'12)**
  - **Identifying plant species**

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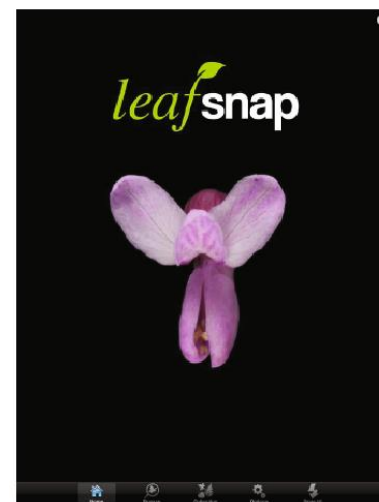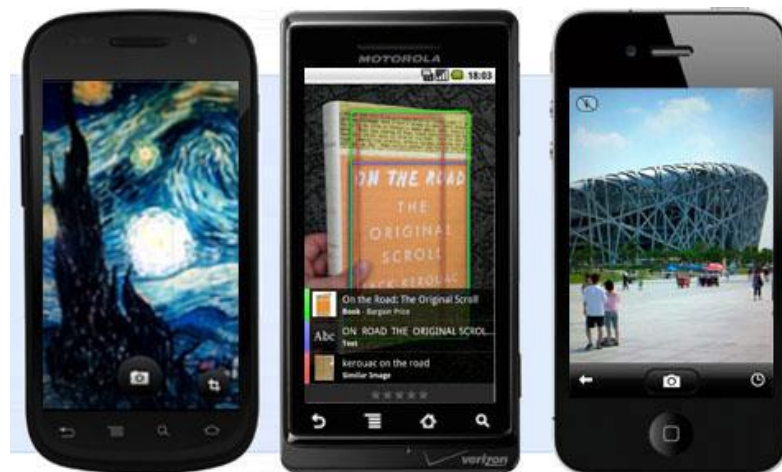
Image Recognition

- **Image Features:**
  - **Color Patch FV (only mean)**
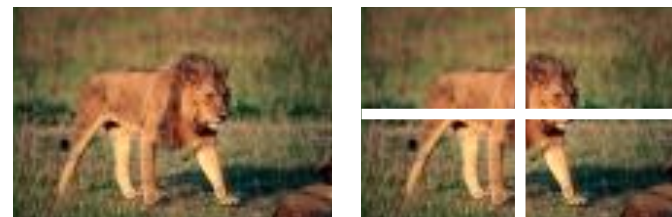   - **24 dim local color descriptor**
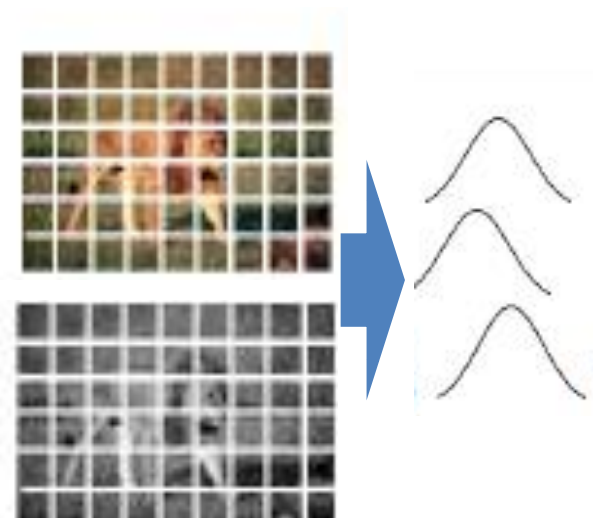 - **RootHOG Patch FV (only mean)**
    - **32 dim local RootHOG descriptor**
    - **Similar to RootSIFT**
  - **SPM**
    - **Level 1 (1x1+2x2)**
  - **FeatureSize**
    - **Color FV: 7680dim, RootHOG FV: 10240dim**

Classifier

- ## Linear Classifier:
  - ### AROW
    - #### Online classifier
  - ### one-vs-rest
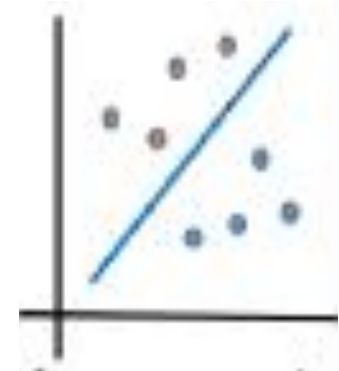
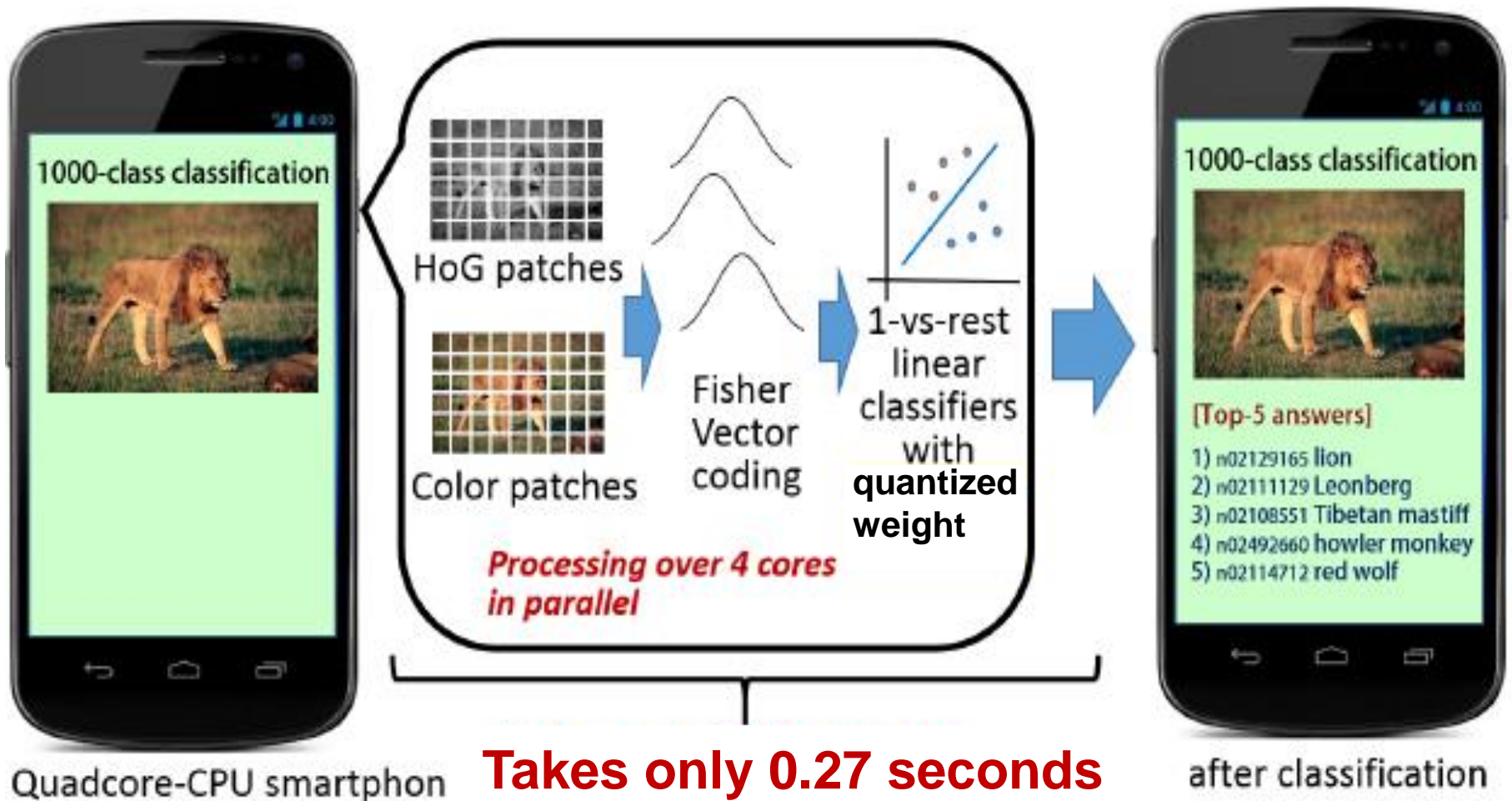**Independent of the number of samples**

computation：$O(N)$

memory　：$O(N)$

- ## Weight vectors
  - ### compressed by scalar-based quantization

Recognition Step

We use light weight features and quantized weight

Quadcore-CPU smartphon

Takes only 0.27 seconds

after classification

Performance

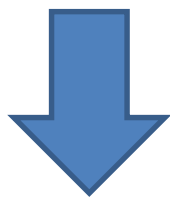- **Top-5 classification rate on ILSVRC**

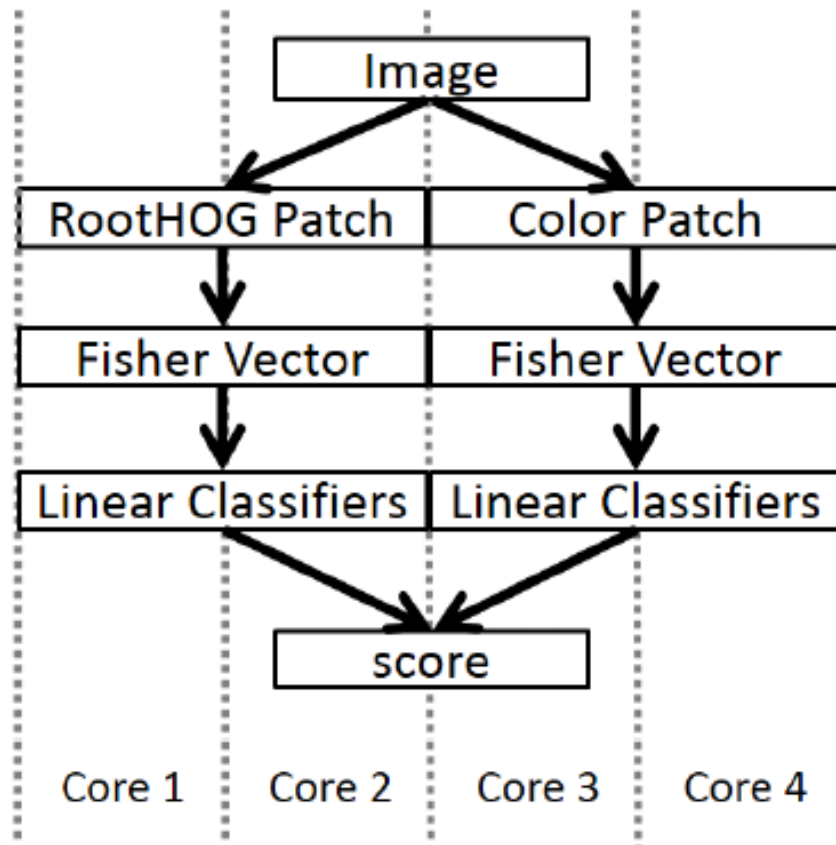|	uncompressed	compressed
Rate	48.7%	47.9%
Memory	71.7MB	9.0MB

- **Only slight performance loss**
  - **About 1%**

Implementation

- **4 core processing**
  - **Extract descriptors**
  - **Feature coding**
  - **Classifies**
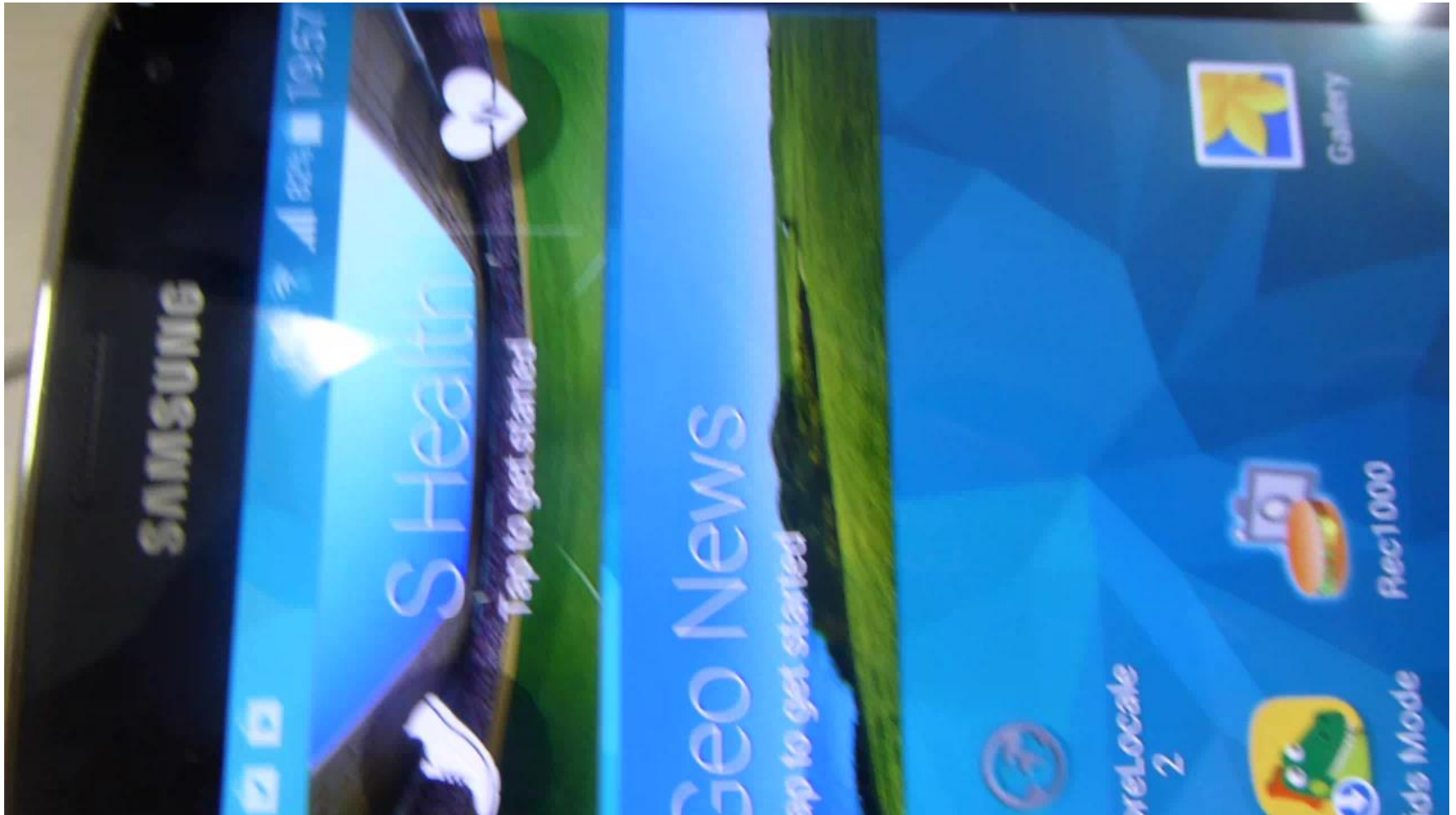- **Offline processing**

- **Recognition time: 0.27 second**
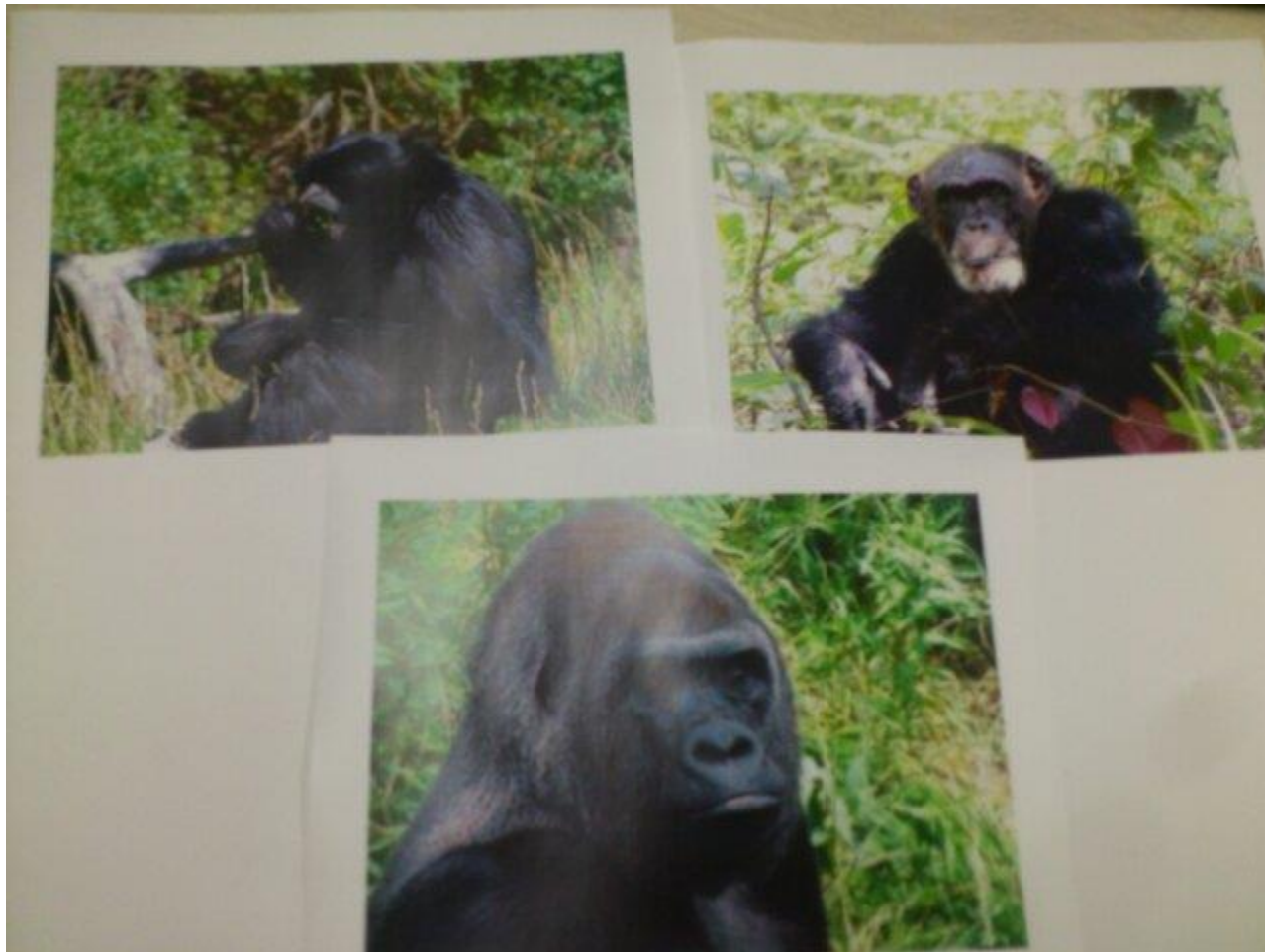 - **1.6GHz Quad Core (Galaxy Note 2)**

DEMO

Mouse -> cup -> desktop -> web

siamang, gollira, chimpanzee

siamang -> gollira -> chimpanzee