Visual Computing for Kakaomap

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카카오
Visual computing is a generic term for all computer science disciplines handling with images and 3D models, i.e., computer graphics, image processing, visualization, computer vision, virtual and augmented reality, video processing, but also includes aspects of pattern recognition, human computer interaction, machine learning and digital libraries. The core challenges are the acquisition, processing, analysis and rendering of visual information (mainly images and video). Application areas include industrial quality control, medical image processing and visualization, surveying, robotics, multimedia systems, virtual heritage, special effects in movies and television, and computer games.

Part 0
Visual Computing for Kakaomap
3D Skyview

전국 지도의 변모를 확인할 수 있는

Roadview

지상의 정보를 빠르게 확인 가능한

VisualComputing X Kakaomap
Aerial Image

Road Image
Visual Computing for Kakaomap

Contents

1. Aerial Image Processing
항공영상을 이용한 처리 과정
- 3D Object Processing
  3차원 객체 처리 방법, 3D 스카이뷰 제작 과정
- 2D Image Processing
  2차원 영상 처리 방법, 스카이뷰 업데이트 과정

2. Road Image Processing
도로영상을 이용한 처리 과정

3. Service Application
카카오맵의 현재. 그리고 준비하고 있는 것.
Part 1

AERIAL IMAGE PROCESSING
1. Aerial Image Processing

Capture Aerial image from Aircraft

Aircraft
+ Digital Camera (DMC / Ultra-cam)
+ IMU
+ GPS

Aerial Image
1. Aerial Image Processing

Data Specification

Coordinate (X, Y, Z)  Format: GeoTiff
Position(Roll, Pitch, Yaw)  Size: 7,680X13,824 (RGB)
1. Aerial Image Processing

Processing Type

- Capturing zigzag method
- Type Check Overlap Ratio
- Processing 3D or 2D
- Service output

- 3D Object Processing
- 3D Skyview Service

- 2D Image Processing
- Skyview Service
1. Aerial Image Processing – 3D Object Processing

3D Object Processing – (Data Flow)

- Aerial Image
  - Image Matching & Pose Estimation
  - DSM Generation
  - Ortho-Map Generation
  - OrthoMap
- DEM Generation
- Building Mask
- DEM
- Polygon Model Generation
- Texture Mapping
- 3D Model
1. Aerial Image Processing – 3D Object Processing

3D Object Processing - Terms

Terrain + Building Elevation

Terrain Elevation

Polygon Model Generation

Texture Mapping

Perpendicular

DSM (Digital Surface Map)

DEM (Digital Elevation Map)

OrthoMap

VisualComputing X Kakaomap
3D Object Processing – (Image Matching ~ DSM Generation)

- **Aerial Image**

  - Path1
  - Path2

- **Image Information**
  - Coordinate (X, Y, Z)
  - Position (Roll, Pitch, Yaw)

- **Tie Point 3D Object**

- **DSM Generation**

- **Pose Estimation**
  - Path1-Img#1
  - Path2-Img#2
  - Path2-Img#3
  - Path1-Img#2
  - Path1-Img#3
1. Aerial Image Processing – 3D Object Processing

3D Object Processing – (Image Matching ~ DSM Generation)

#Step1: Image(s)

#Step2: Image Matching

#Step3: Tie(Object) Point

#Step4: Triangulation

VisualComputing X Kakaomap
1. Aerial Image Processing – 3D Object Processing

3D Object Processing – (OrthoMap Generation)

OrthoMap Generation

Texture Mapping

Terrain

Building

DSM

Image(s)

Perpendicular
1. Aerial Image Processing – 3D Object Processing

3D Object Processing – (DEM ~ 3DModel Generation)

DEM & 3D Model Generation

DEM

DSM + Building Mask

Terrain

Building

(Polygon) Model + Texture Mapping + 3D Model

VisualComputing X Kakaomap
1. Aerial Image Processing – 3D Object Processing

3D Object Processing – (Data Flow with Images)

- Aerial Image
  - Image Matching & Pose Estimation
  - DSM Generation
  - Ortho-Map Generation
  - Building Mask
  - OrthoMap

- Polygon Model Generation
  - Texture Mapping
  - 3D Model
1. Aerial Image Processing – 3D Object Processing

3D Skyview Service

- Aerial Image
- Pose Estimation
- DSM (Digital surface Map)
- DEM (Digital Elevation Map)
- 3D Model
- Texture Mapping
- OrthoMap
- 3DSkyview Service

Visual Computing X Kakaomap
1. Aerial Image Processing – 3D Object Processing

3D Skyview Coverage

- 2017년 서비스 시작.
- 270만 동의 건물 서비스 종 (2019.08.30. 기준)
- 전국 광역시 및 주요 지자체 서비스

VisualComputing X Kakaomap
1. Aerial Image Processing – 3D Object Processing

How to use 3D Skyview
1. Aerial Image Processing – 3D Object Processing

DEM Application
1. Aerial Image Processing

**Processing Type**

- **Capturing zigzag method**
- **Type Check Overlap Ratio**
- **Processing 3D or 2D**
- **Service output**

**3D Object Processing**
- 80% ↑ X 60% ↑

**2D Image Processing**
- 60% ↓ X 40% ↓

- **3D Skyview Service**
- **Skyview Service**
1. Aerial Image Processing – 2D Image Processing

2D Image Processing - (Data Flow)

- Aerial Image
- Raster Align
- Color Balancing
- Boundary Blending
- Skyview
- (Update Region) Raster Mask
- Raster
1. Aerial Image Processing – 2D Image Processing

2D Image Processing - (Color Balancing)

Aerial Image
Texture Align

Color Balancing

Skyview
(Reference)

Color Balancing Result
1. Aerial Image Processing – 2D Image Processing

2D Image Processing - (Color Balancing)
1. Aerial Image Processing – 2D Image Processing

2D Image Processing - (Color Balancing)
1. Aerial Image Processing – 2D Image Processing

Skyview Service
Part 2

ROAD IMAGE PROCESSING
2. Road Image Processing

Get Information from Roadview
2. Road Image Processing

Roadview Information

- Crosswalk
- RoadSign
- Sky
- Car
- Building
- Direction Info
- Lane
- Sidewalk
- Road
- SignBoard
2. Road Image Processing

Capture Road image from MMS

Roadview
+ Digital Camera (Fisheye Lens)
+ INS
+ GPS

Road Image
2. Road Image Processing

Lane / Direction Info. Detection

Lane Class: 29
Direction Info. Class: 20

Crosswalk
Direction Information
Lane
2. Road Image Processing

Lane / Direction Info. Detection
2. Road Image Processing

Lane / Direction Info. Ray Intersection

Ray <-> Terrain Intersection
2. Road Image Processing

Lane / Direction Info.

Lane : 5
Cross walk = true
Car : 3rd

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2. Road Image Processing

Road Sign / Signboard

- 주정차 금지
- 60 제한
- 유틸 가능
- 유틸 금지

VisualComputing X Kakaomap
2. Road Image Processing

Road Sign / Signboard Ray Intersection
2. Road Image Processing

Road Sign / Signboard Ray Intersection

Ray ↔ Building Intersection

Building ID

인랑
강남탑
ARTBO
MEGAB
...

Place DB

YES24 중고시점
강남탑한의원
기억사과의원
...
배가박스
아드박스
푸른안경
...

변경여부활용

인랑 → 신규 확인
강남탑 → 강남탑한의원 → 변경없음
ARTBO → 아드박스 → 변경없음

VisualComputing X KakaoMap
2. Road Image Processing

Building

VisualComputing X Kakaomap
2. Road Image Processing

Roadview Service

Smart Jump(Depth)
Building Info./Shape
2. Road Image Processing

Detection Result
2. Road Image Processing

Application

- Building
- Lane
- Tree
- Crosswalk
- Direction Sign
- Database
- Road Sign

Crosswalk

Lane / Direction Info.
Road Sign

VisualComputing X Kakaomap
2. Road Image Processing

Application

- Building
- Lane
- Tree
- Database
- Crosswalk
- Direction Sign
- Road Sign

Signboard

Parking
Aerial / Road Image Processing

Capture Real Environment
- Aircraft, Drone, MMS의 다양한 장비를 이용하여, 
  실제 세계를 촬영. 
- Aerial / Road영상 데이터 획득.

Get Information
- 다중 센서로부터 획득된 
  영상 데이터를 
  비주얼컴퓨팅 기술을 통해 
  분석하여, 다양한 정보를 
  취득.

Service Application
- 다양한 정보를 각 서비스 
  특성에 맞춰 취사 선택 및 
  활용함. 
- POI와 같은 직접적인 표출 
  외에도 내부적 연계를 
  위해 활용될 수 있음.

Management
- 다양한 정보를 빠르게 
  취득하고 업데이트 하여 
  서비스에 반영할 수 있는 
  데이터 베이스 

Various Information

Kakao Map Service

Visual Computing X Kakao Map
Part 3

Service Application
Kakaomap Service

With 제주특별자치도
제주 초-정밀
버스위치정보 서비스
Visual Computing for Kakaomap