
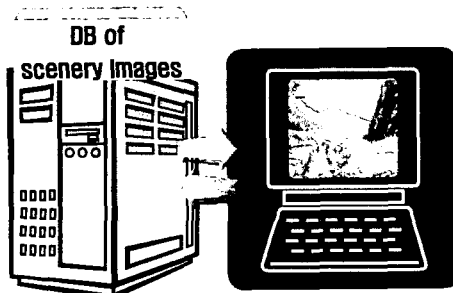


Construction of Database System  
using shape recognition technique  
for casting metal mold design and product management

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**CONTENT BASED IMAGE RETRIEVAL METHOD** 

DB of scenery images 

**text based retrieval**  
Input the keyword :  
mountains, rivers, the sky and trees

**Ineffective to retrieve data**

**Content based Image retrieval**  
The technology is developed using  
the content information of an image  
such as color, texture and shape  
(this method is progressed a lot in the image engineering field)

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**TEXT BASED  
DB SYSTEM**

Difficult to construct and retrieve data

Difficult for a non expert to use

Hard to graft it on to the expert system



Develop the database system using  
content based image retrieval method with the creative idea.  
(especially shape retrieval technology)

**2D/3D RETRIEVAL SYSTEM**

**3D-3D retrieval system**

- ※ Require high computational complexity
- ※ User must provide 3D data information



**2D/3D retrieval system**

- ※ Use 2D shape descriptor
- Shape analysis using Angular Radial Transformation descriptor

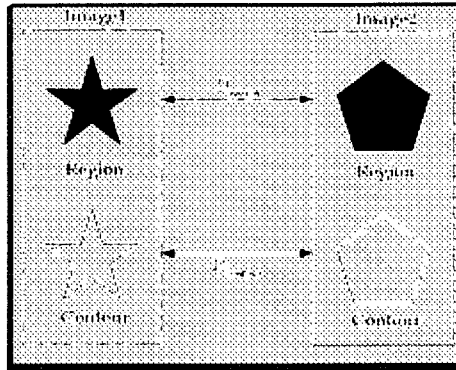
## Main Method to Retrieve a 2D Image

### Region-based method

- Using shape energy moment function

### Contour-based method

- Using single contour of object and its variation



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## Shape Feature Extraction with ARTransform

### Characteristics

- Shape features with rotations, scaling, shift invariants
- Low computational cost

### Feature Extraction Procedure

- Normalization of silhouette image
- Calculation AR coefficients

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## Definition

Orthogonal unitary transform defined on a unit disk

$$F_{nm} = \langle V_{nm}(\rho, \theta), f(\rho, \theta) \rangle$$

$$= \int_0^{2\pi} \int_0^1 V_{nm}^*(\rho, \theta) f(\rho, \theta) \rho d\rho d\theta$$

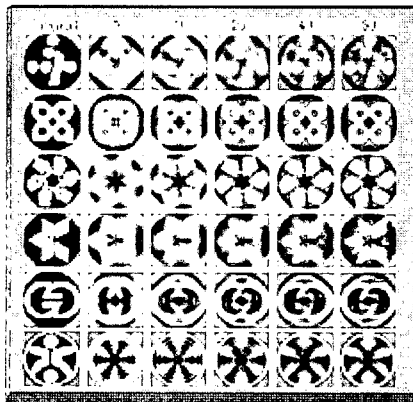
where

$$V_{nm}(\rho, \theta) = A_m(\theta) R_n(\rho) \begin{cases} R_n(\rho) = \begin{cases} 1 & n = 0 \\ 2 \cos(\pi n \rho) & n \neq 0 \end{cases} \\ A_m(\theta) = \frac{1}{2\pi} \exp(jm\theta) \end{cases}$$

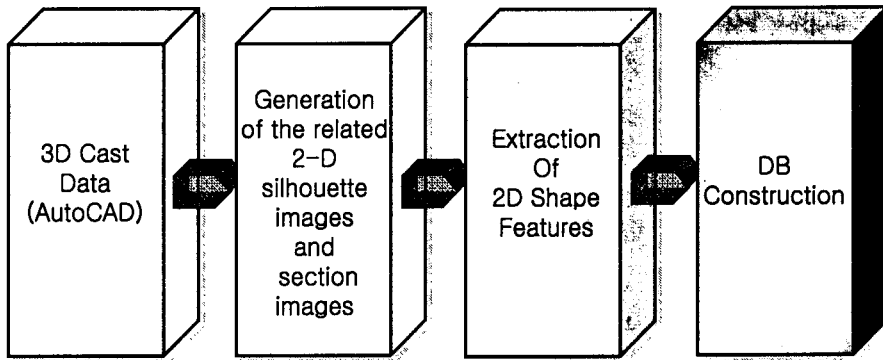
- The characteristic values preserve the rotation, size and movement
- Low computational cost

ART is the latest technology with the highest performance among shape retrieval technologies.

Image reconstruction using partial AR coefficients

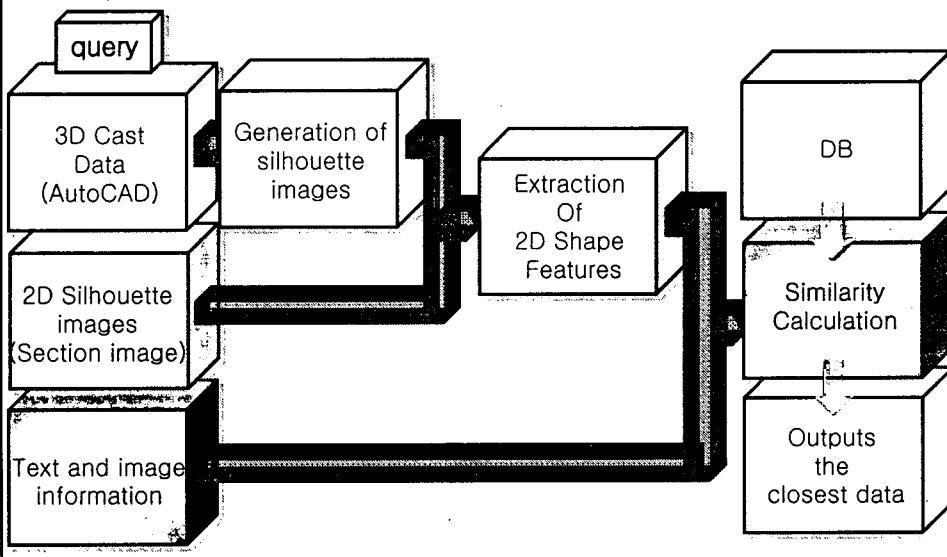


# GENERAL COMPOSITION OF THE DATABASE



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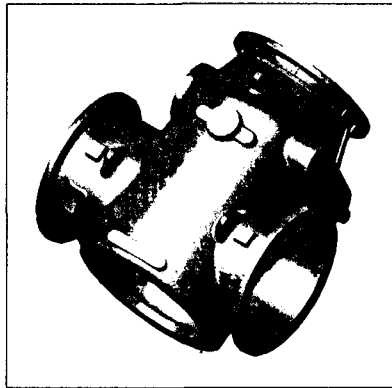
# GENERAL COMPOSITION OF THE DATABASE



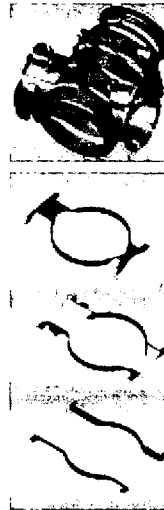
# HOW CAN WE MAKE A SHAPE DB SYSTEM ?



2D silhouette Image Data

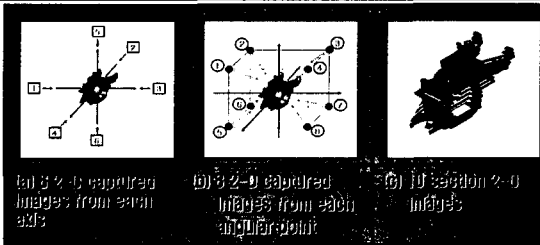


Section of the product



Section Data<sub>11</sub>

# HOW CAN WE MAKE A SHAPE DB SYSTEM ?

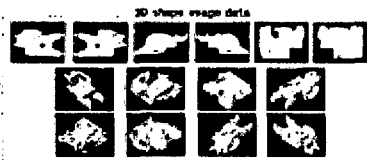


(a) 2-0 captured images from each edge

(b) 2-0 captured images from each angular point

(c) 10 section 2-0 images

Car CAD data

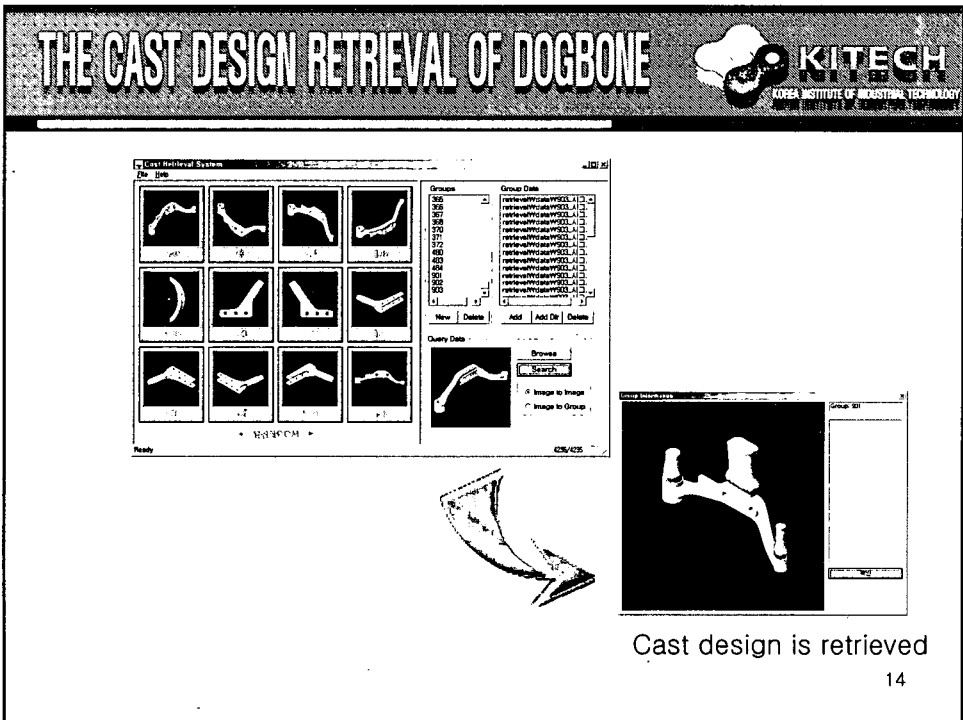
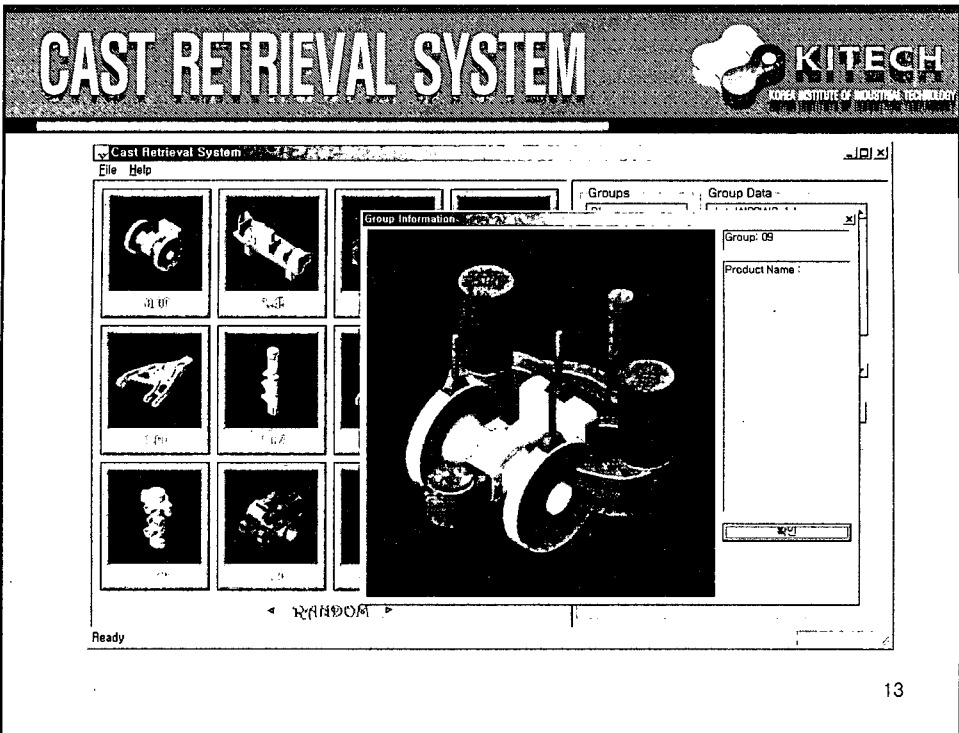


2D shape image data



2D section image data

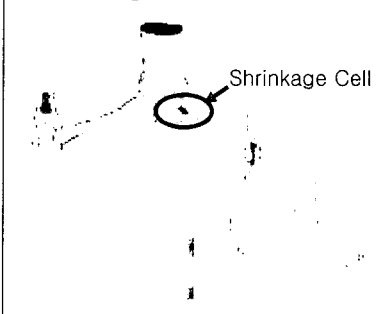
2D silhouette image & section image from the 3D object



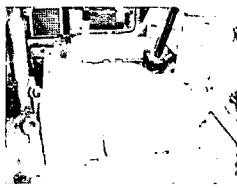
# THE CAST DESIGN RETRIEVAL OF DOGBONE



Initial Design



Optimal Design



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# THE FUTURE TASKS



## Planning to development of IES

Considering the number of risers and chill in the optimal riser design system

the development of casting design system by the fluid judgment of a defect

the development of the reasoning technology for the optimization of heat treatment process

the development of the optimal metal mold design system considering the chilling line

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