# N-view Depth Consistency Testing Algorithm

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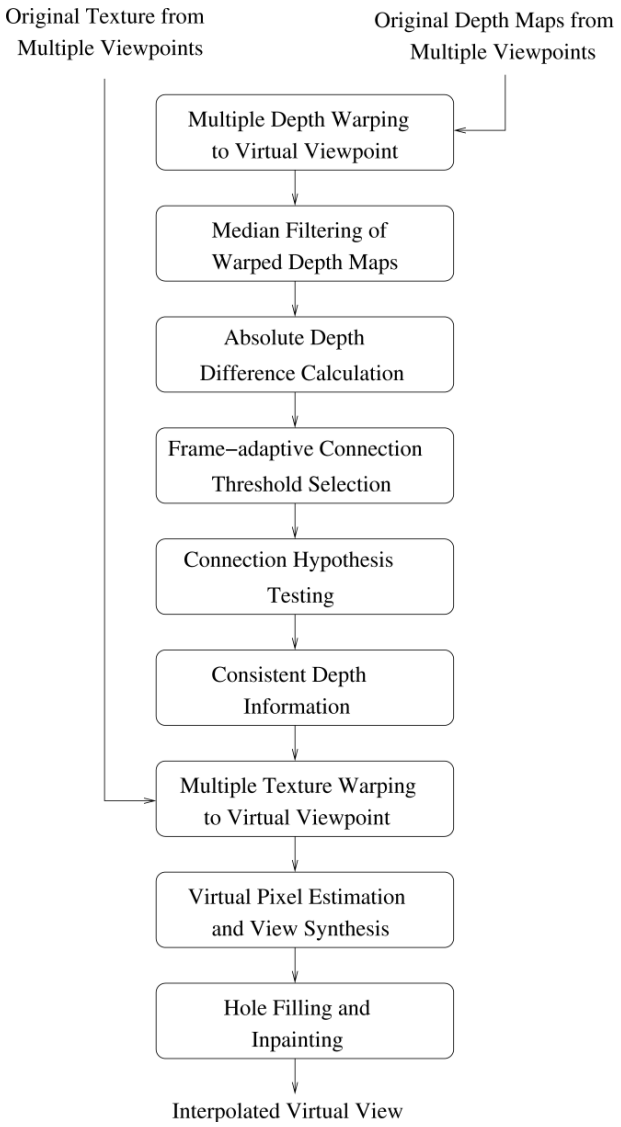
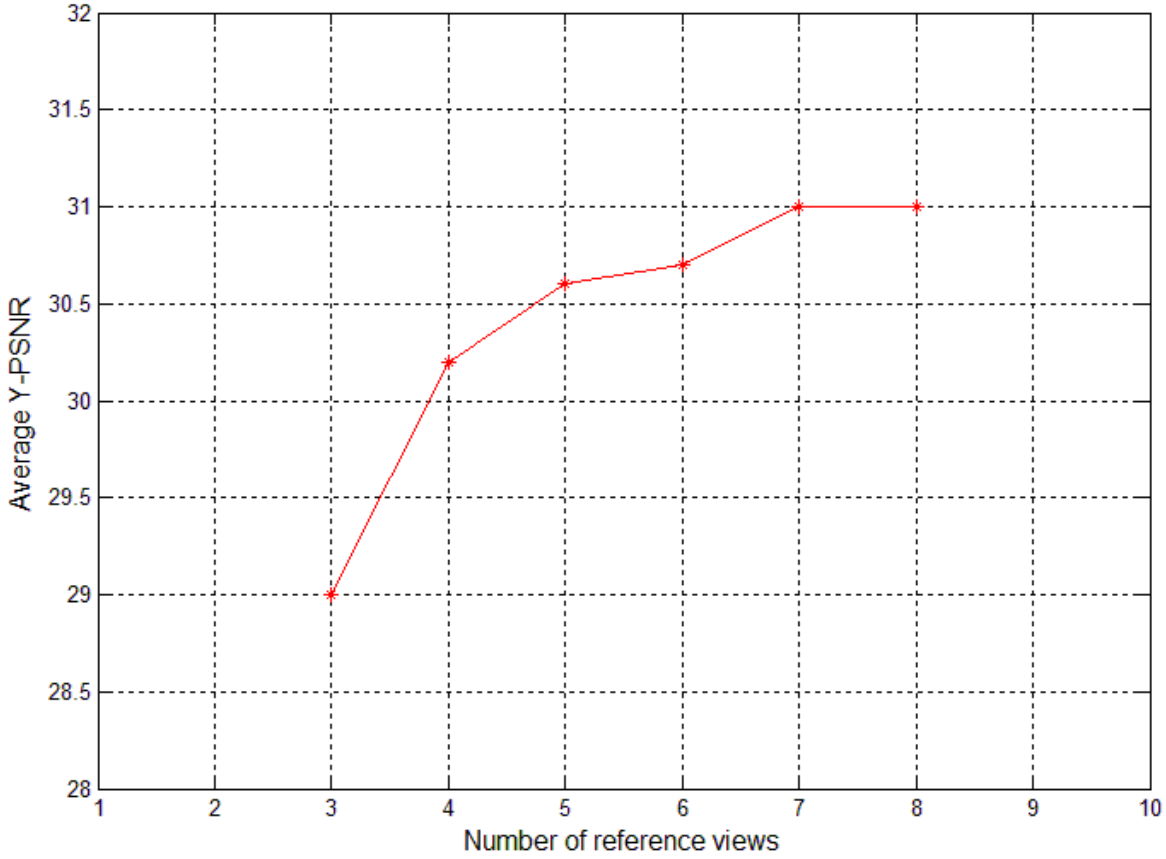
# Outline

- N-view Depth Consistency Testing Algorithm (DCTA)
- Adaptive Connection Threshold: Cluster Approach

# Depth Consistency Testing Algorithm(DCTA)



# N-view DCTA Performance

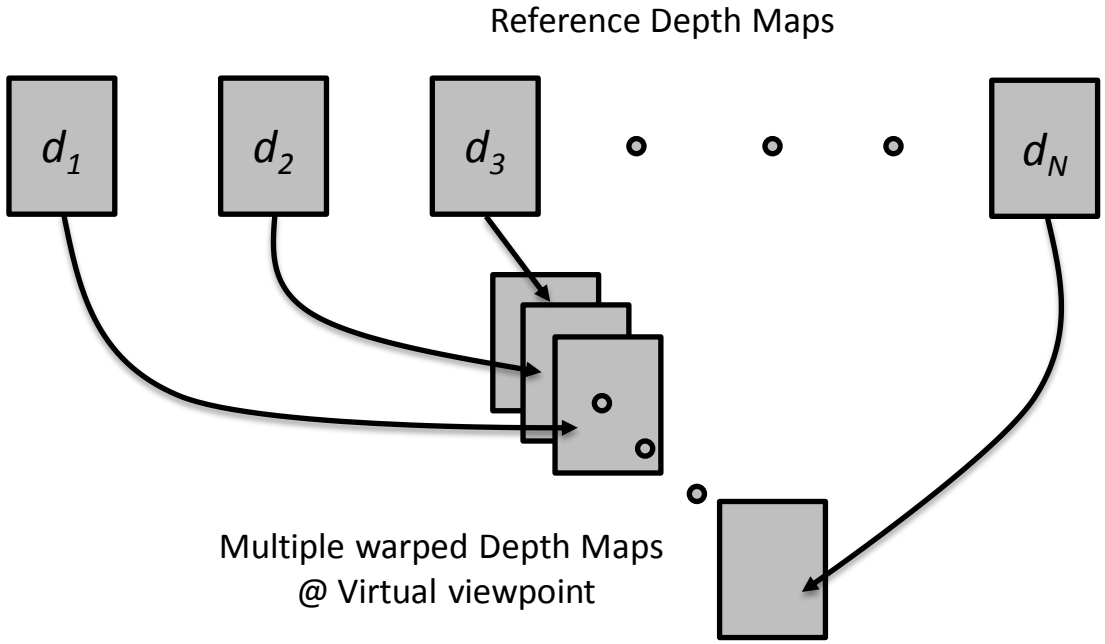


# N-view DCTA Performance

**Table 1.**
**Average PSNR (in dB) of the virtual view synthesized by using N-view DCTA supported View Synthesis (Averaged over 10 frames ).**

| Test Sequences | Virtual Viewpoint | Number of References | | | | | |
|---|---|---|---|---|---|---|---|
| | | #3 | #4 | #5 | #6 | #7 | #8 |
| **Pantomime** | 40 | 39.3 | 39.8 | 39.8 | 40.3 | 40.5 | 40.2 |
| **Dog** | 43 | 29.6 | 32.0 | 32.8 | 33.5 | 33.3 | 32.6 |
| **Newspaper** | 04 | 28.7 | 30.3 | 30.5 | 30.7 | X | |
| **Lovebird1** | 07 | 29.0 | 30.2 | 30.6 | 30.7 | 31.0 | 31.0 |

# Connection Threshold




Depth Difference Matrix(DDM)

$$= \begin{pmatrix} 0 & \Delta_{1,2} & \Delta_{1,3} & \cdots & \Delta_{1,N} \\ \Delta_{2,1} & 0 & \Delta_{2,3} & \cdots & \Delta_{2,N} \\ \Delta_{3,1} & \Delta_{3,2} & 0 & \cdots & \Delta_{3,N} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \Delta_{N,1} & \Delta_{N,2} & \Delta_{N,3} & \cdots & 0 \end{pmatrix}$$

$$where, \Delta_{i,j} = (d_i - d_j);$$

# Connection Threshold : A Cluster Approach

**Depth Difference Matrix (DDM)**

$$= \begin{pmatrix} 0 & \Delta_{1,2} & \Delta_{1,3} & \cdots & \Delta_{1,N} \\ \Delta_{2,1} & 0 & \Delta_{2,3} & \cdots & \Delta_{2,N} \\ \Delta_{3,1} & \Delta_{3,2} & 0 & \cdots & \Delta_{3,N} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \Delta_{N,1} & \Delta_{N,2} & \Delta_{N,3} & \cdots & 0 \end{pmatrix}$$

Cluster A

$$\begin{pmatrix} 0 & 0 & 0 & \cdots & 0 \\ 0 & 0 & 0 & \cdots & 0 \\ 0 & 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \cdots & 0 \end{pmatrix}$$

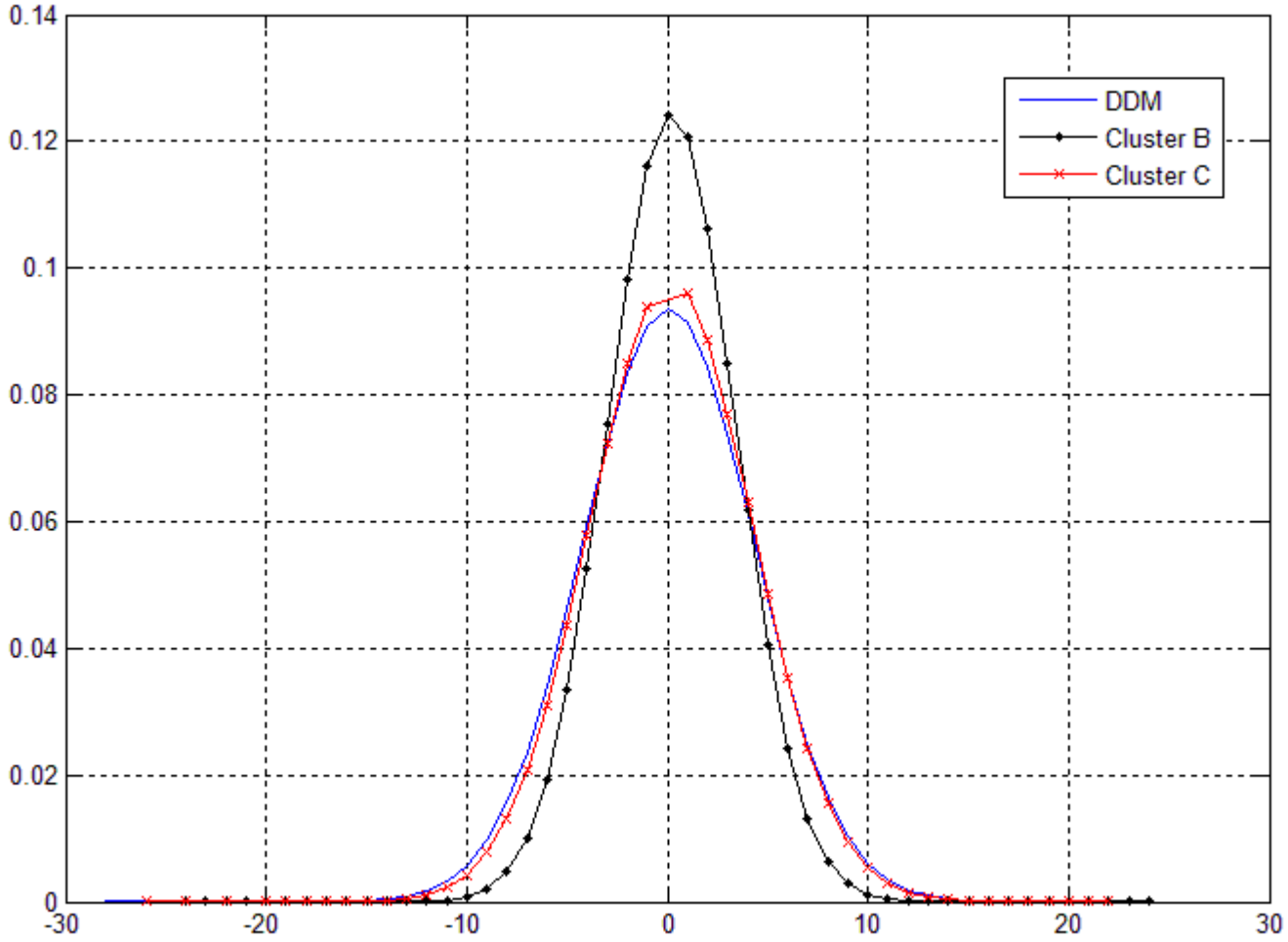
Cluster B

$$\begin{pmatrix} 0 & 0 & \Delta_{1,3} & \cdots & \Delta_{1,N} \\ 0 & 0 & \Delta_{2,3} & \cdots & \Delta_{2,N} \\ \Delta_{3,1} & \Delta_{3,2} & 0 & \cdots & \Delta_{3,N} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \Delta_{N,1} & \Delta_{N,2} & \Delta_{N,3} & \cdots & 0 \end{pmatrix}$$

Cluster C

$$\begin{pmatrix} 0 & \Delta_{1,2} & \Delta_{1,3} & \cdots & \Delta_{1,N} \\ \Delta_{2,1} & 0 & \Delta_{2,3} & \cdots & \Delta_{2,N} \\ \Delta_{3,1} & \Delta_{3,2} & 0 & \cdots & \Delta_{3,N} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \Delta_{N,1} & \Delta_{N,2} & \Delta_{N,3} & \cdots & 0 \end{pmatrix}$$

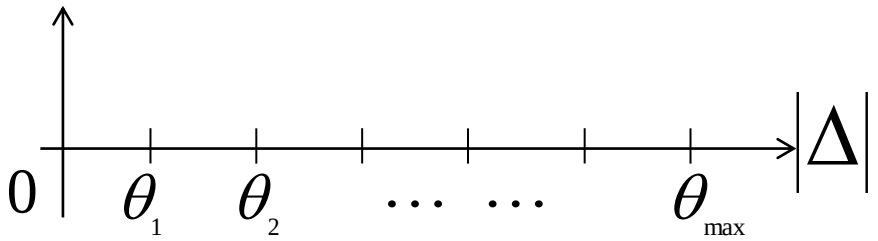
# Cluster Distribution




3 reference-view scenario

# Relative Distance Classification for Class C Cluster

$$\Delta = \begin{pmatrix} 0 & \Delta_{1,2} & \Delta_{1,3} & \cdots & \Delta_{1,N} \\ \Delta_{2,1} & 0 & \Delta_{2,3} & \cdots & \Delta_{2,N} \\ \Delta_{3,1} & \Delta_{3,2} & 0 & \cdots & \Delta_{3,N} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \Delta_{N,1} & \Delta_{N,2} & \Delta_{N,3} & \cdots & 0 \end{pmatrix}$$




*where,*

$$\theta_1 = \min\left\{\left[\Delta_{i,j}\right] \middle| \Delta_{i,j} > 0;\ \mathrm{j} > i\right\}$$

$$\theta_2 = \min\left\{\left[\Delta_{i,j}\right] \middle| \Delta_{i,j} > \theta_1;\ \mathrm{j} > i\right\}$$

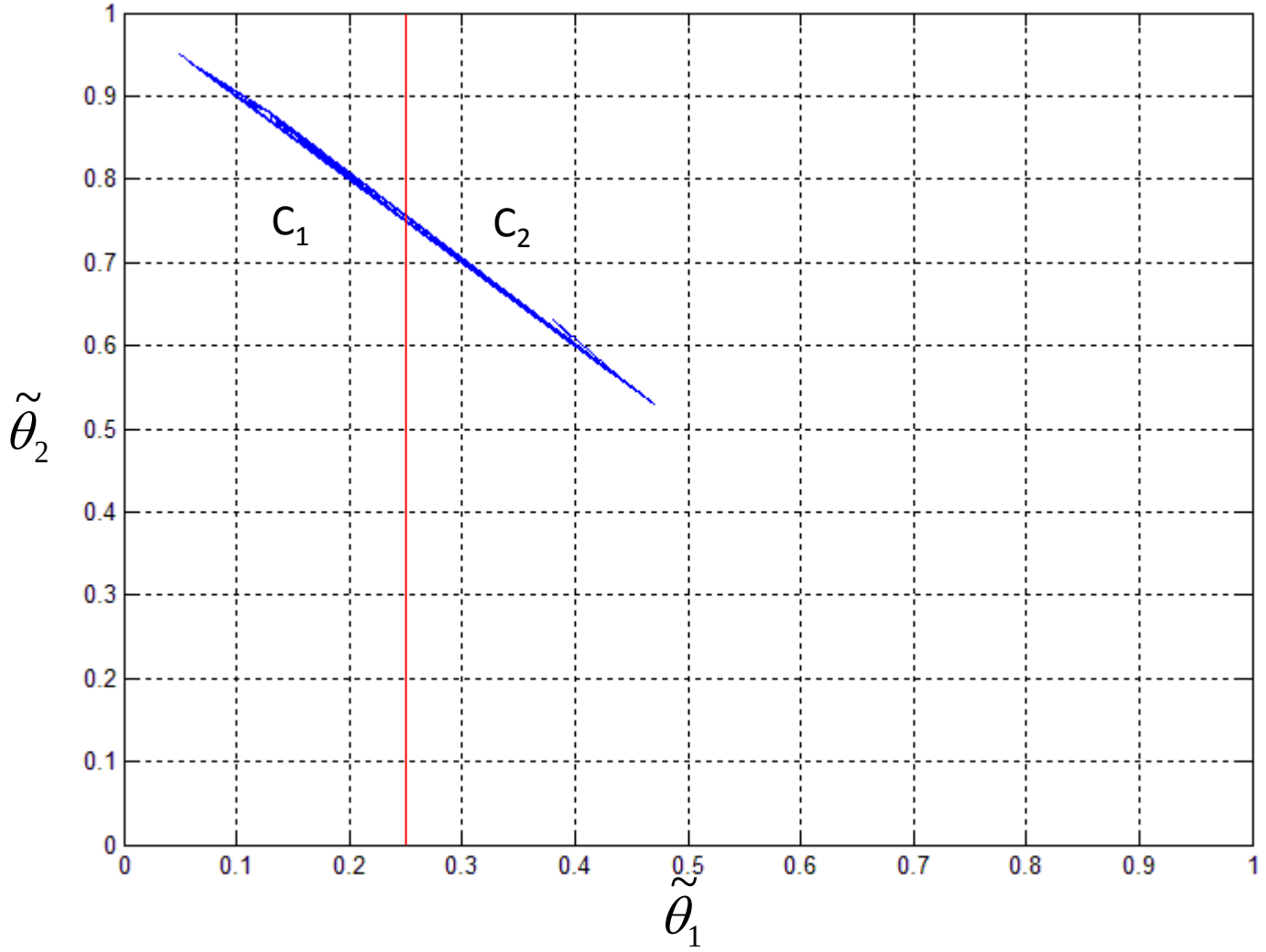
… … …

Define relative distances :

$$\tilde{\theta}_1 = \frac{\theta_1}{\theta_{\max}},\ \tilde{\theta}_2 = \frac{\theta_2}{\theta_{\max}},\ \cdots\ \cdots, 1$$

# Relative Distance Classification for Class C Cluster

3 reference-view scenario



# Connection Threshold

Class A Cluster Depth Pixel $\quad T_A = 0.0$

Class B Cluster Depth Pixel $\quad T_B <= 2\sigma_B$

Class C Cluster Depth Pixel

$if \quad \tilde{\theta}_1 < 0.25 \quad \rightarrow$ Class $C_1$ Cluster

$if \quad \tilde{\theta}_1 \geq 0.25 \quad \rightarrow$ Class $C_2$ Cluster

Class $C_i$ Cluster Depth Pixel $\quad T_{C_i} <= 2\sigma_{C_i}$

# N-view DCTA Performance

| Test Sequences | Virtual Viewpoint | Cluster A, plus | Number of References | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | #3 | #4 | #5 | #6 | #7 | #8 |
| **Pantomime** | 40 | B, C | 39.2 | 39.7 | 39.8 | 40.3 | 40.0 | 39.6 |
| | | B, $C_1$, $C_2$ | 39.3 | 39.8 | 39.8 | - | - | - |
| | | $B_1$, $B_2$ | - | - | - | - | 40.5 | 40.2 |
| **Dog** | 43 | B, C | 29.0 | 30.7 | 32.5 | 33.5 | 33.3 | 32.6 |
| | | B, $C_1$, $C_2$ | 29.6 | 31.0 | 32.8 | - | - | - |
| **Newspaper** | 04 | B, C | 28.1 | 29.9 | 30.2 | 30.7 | X | |
| | | B, $C_1$, $C_2$ | 28.7 | 30.2 | 30.5 | 30.7 | | |
| **Lovebird1** | 07 | B, C | 28.6 | 29.8 | 30.3 | 30.7 | 31.0 | 31.0 |
| | | B, $C_1$, $C_2$ | 29.0 | 30.2 | 30.6 | - | - | - |

**Table 2: Average PSNR (in dB) of the virtual view synthesized by using N-view DCTA supported View Synthesis (Averaged over 10 frames ).**