

Resampling을 통한 특정 주기 속성 파악

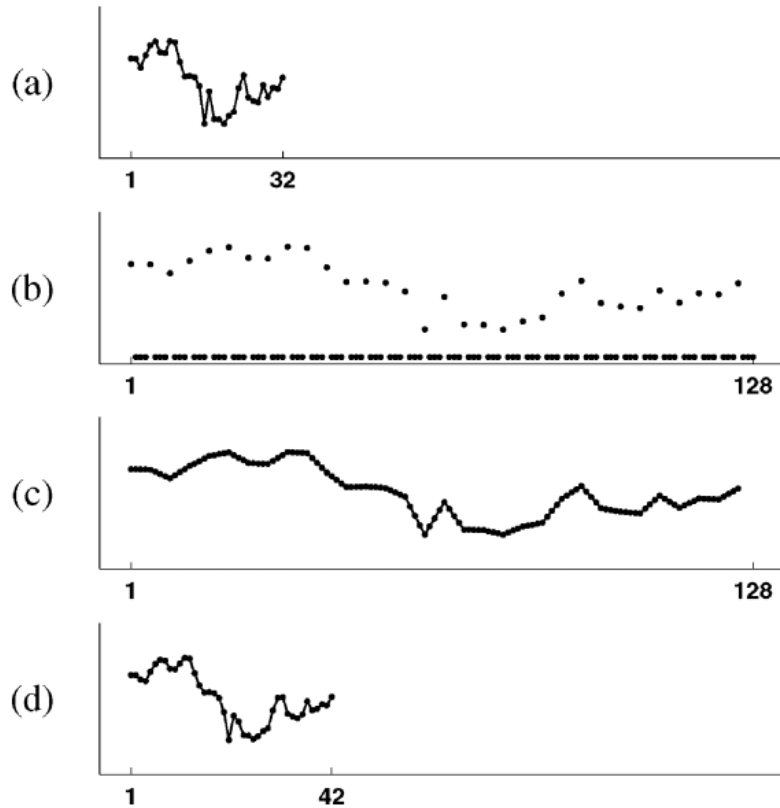
20185153 이상영

Resampling & Interpolation

- 이미지 위조 → 이미지의 기본 통계 변화 분석
- Interpolated signal에는 감지 가능한 **특정 주기 속성**이 존재.

Resampling Signals

Exposing digital forgeries by detecting traces of resampling(2005)



$$\vec{y} = A_{p/q} \vec{x} \quad A_{2/1} = \begin{bmatrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ & & \ddots \end{bmatrix}.$$

Odd samples: $y_{2i-1} = x_i, i = 1, \dots, m.$

Even Samples: $y_{2i} = 0.5x_i + 0.5x_{i+1}$

➔ 이웃 픽셀과의 상관성을 갖는 주기적 sample을
찾음으로써 detect 가능

Fig. 1. Resampling a signal by a factor of 4/3. (a) Original signal. (b) Up-sampled signal. (c) Interpolated signal. (d) Final resampled signal.

Resampling Signals

Exposing digital forgeries by detecting traces of resampling(2005)

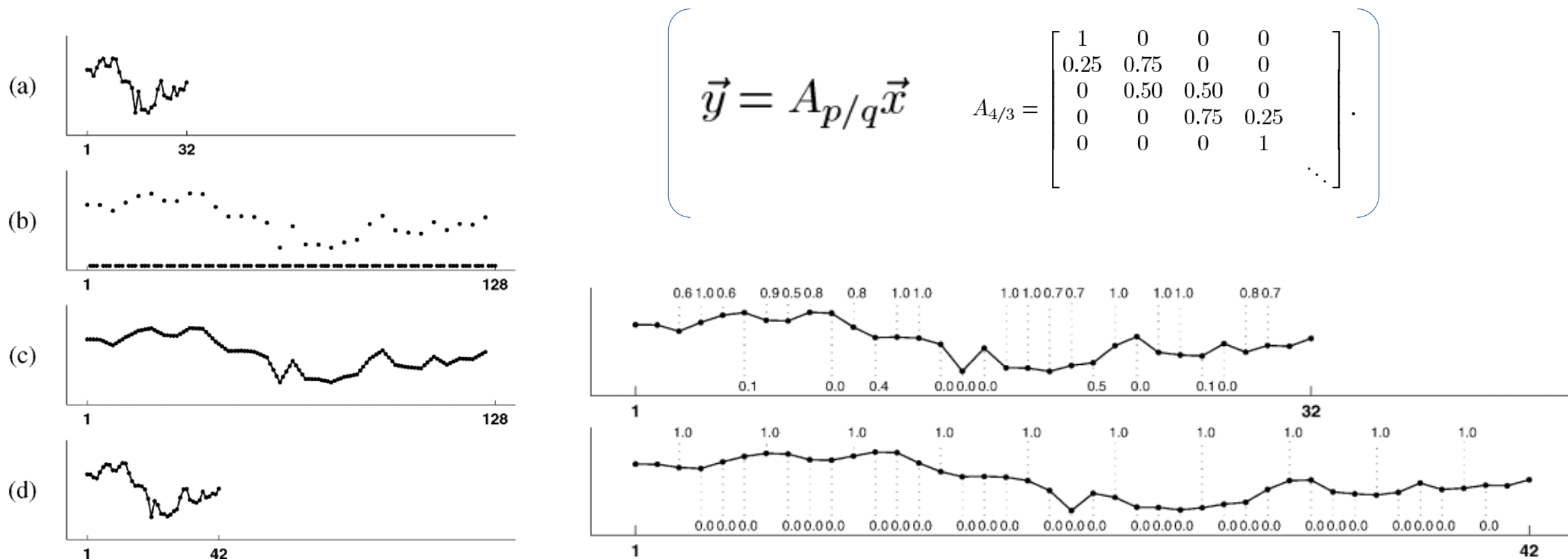
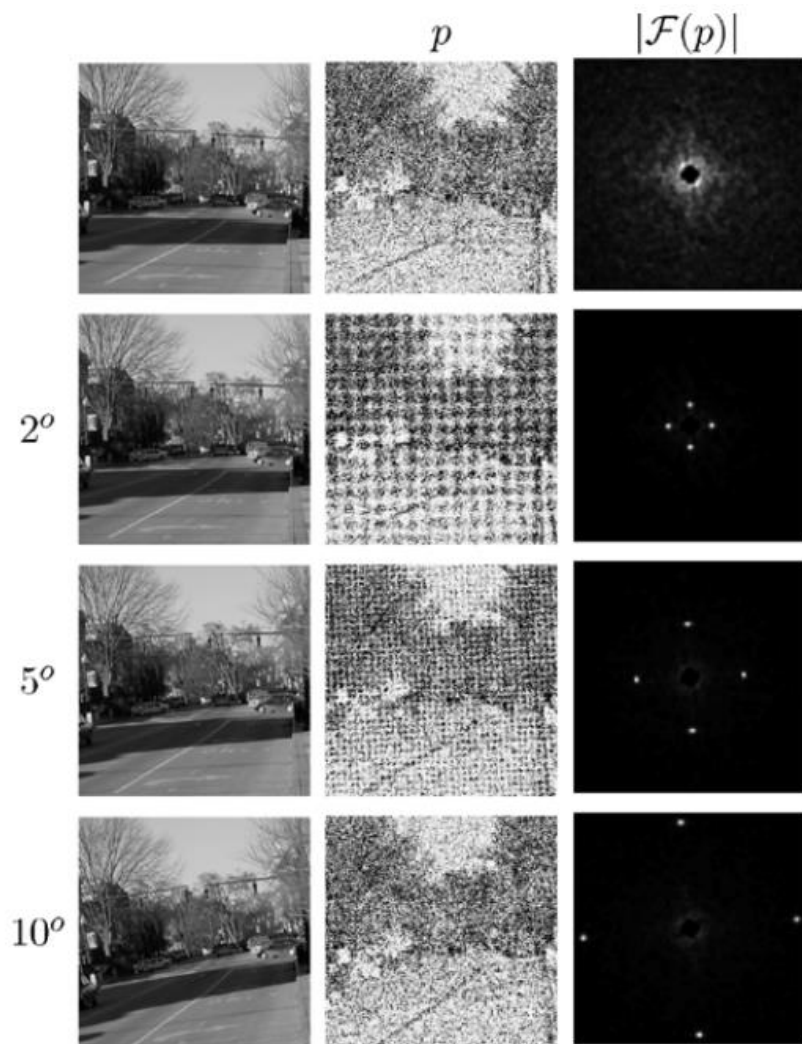


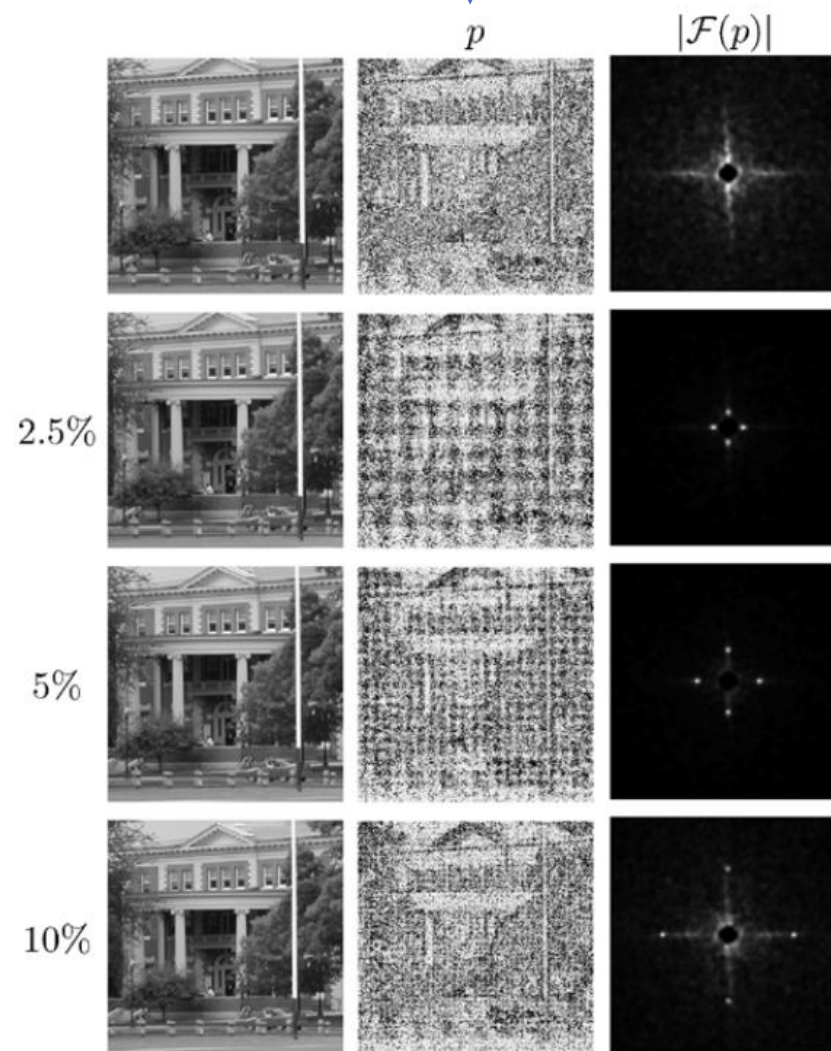
Fig. 1. Resampling a signal by a factor of $4/3$. (a) Original signal. (b) Up-sampled signal. (c) Interpolated signal. (d) Final resampled signal.

Resampling Images

Exposing digital forgeries by detecting traces of resampling(2005)



이미지에서 공간적 상관관계를 나타내는 "추정 확률 맵"



resampling and interpolation의 흔적 감지 방법

Blind Authentication Using Periodic Properties of Interpolation(2008)

- 4가지 방법으로 구성
 1. ROI selection
 2. signal derivative computation
 3. radon transformation
 4. search for periodicity

1. Region of Interest(ROI) Selection

- typical image $f(x,y)$; 여러개의 일관된 영역으로 구성
- 해당 영역의 resampling 여부 조사
- $R \times R$ 픽셀 블록 $b(x,y)$ 으로 해당 영역 선택($R=128$)
- 좌측상단에서 우측하단까지 수평으로 이동

(a)



2. signal derivative computation

- 주기적 특성을 강조하기 위해 $b(x,y)$ 영역의 n 차 미분 계산 $D^n\{b(x,y)\}$
- 실제 실험에서는 $n = 2$ 로 설정

(a)

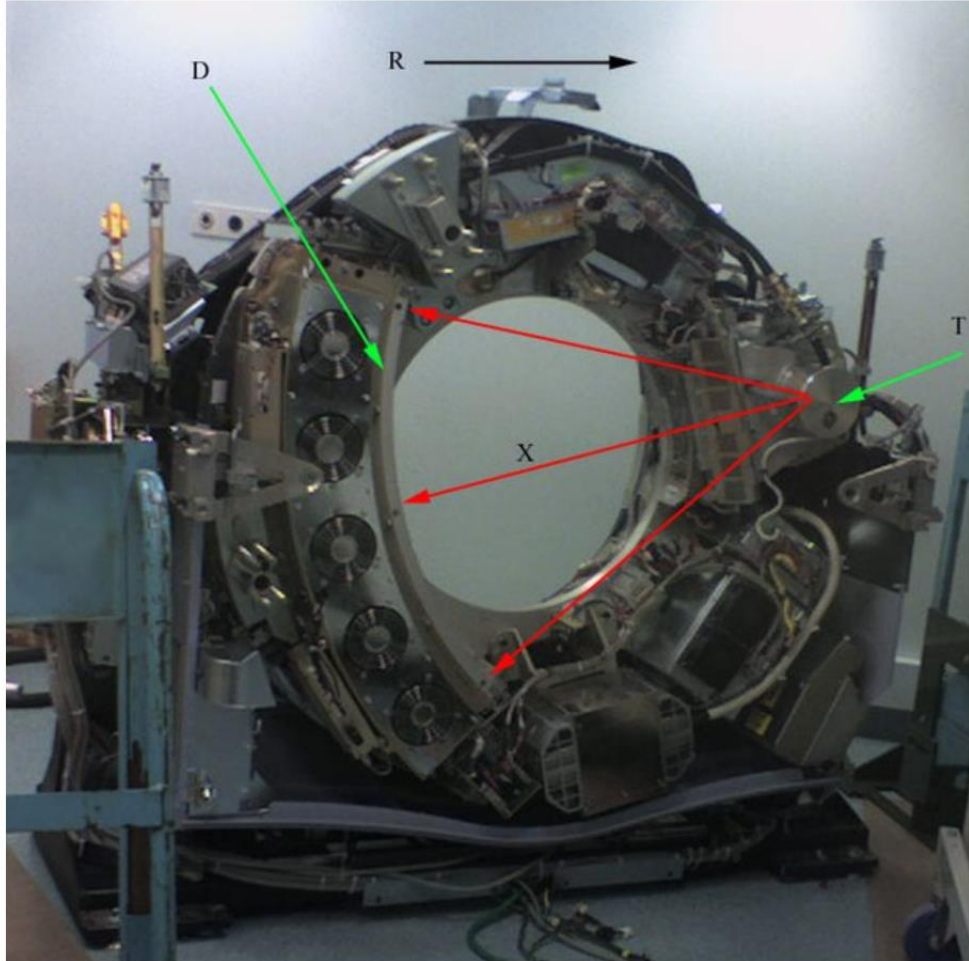


(b)



← Row based signal derivative

3. radon transformation



: T에서 나온 X선이 놓인 물체에 일부 흡수되면서 X선 검출기인 D까지 직선으로 진행

[그림 3] CT 주사기(scanner)의 내부 구조(출처: wikipedia.org)

3. radon transformation

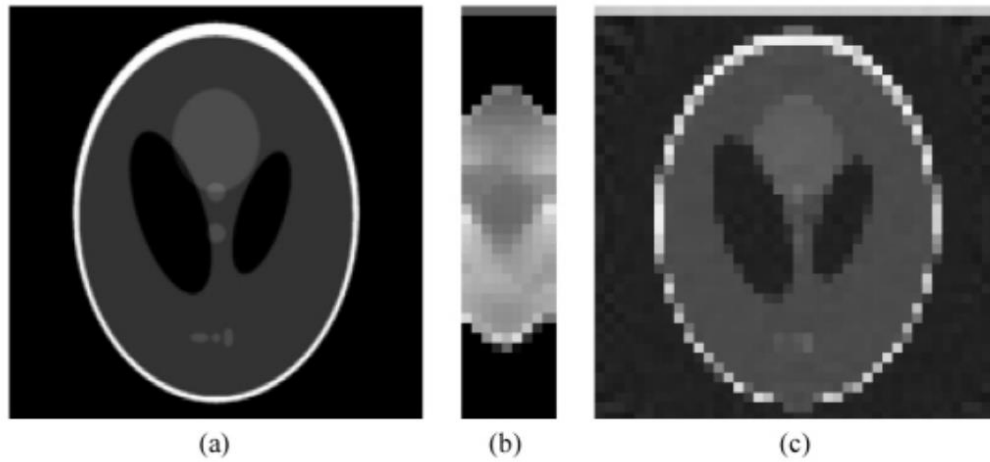
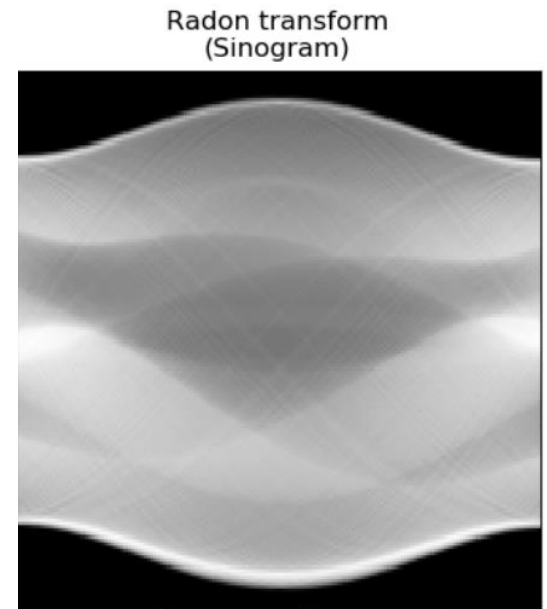


Fig. 6. (a) Shepp-Logan phantom (The Shepp-Logan phantom is a standard test image created by Shepp and Logan (1974)), (b) Radon transform (sinogram), (c) inverse Radon transform.



sinogram: 라돈 변환을 통한 투영 자료

3. radon transformation

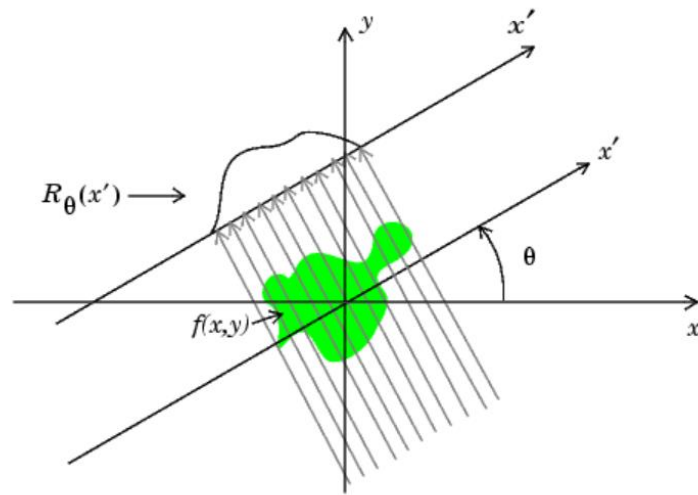
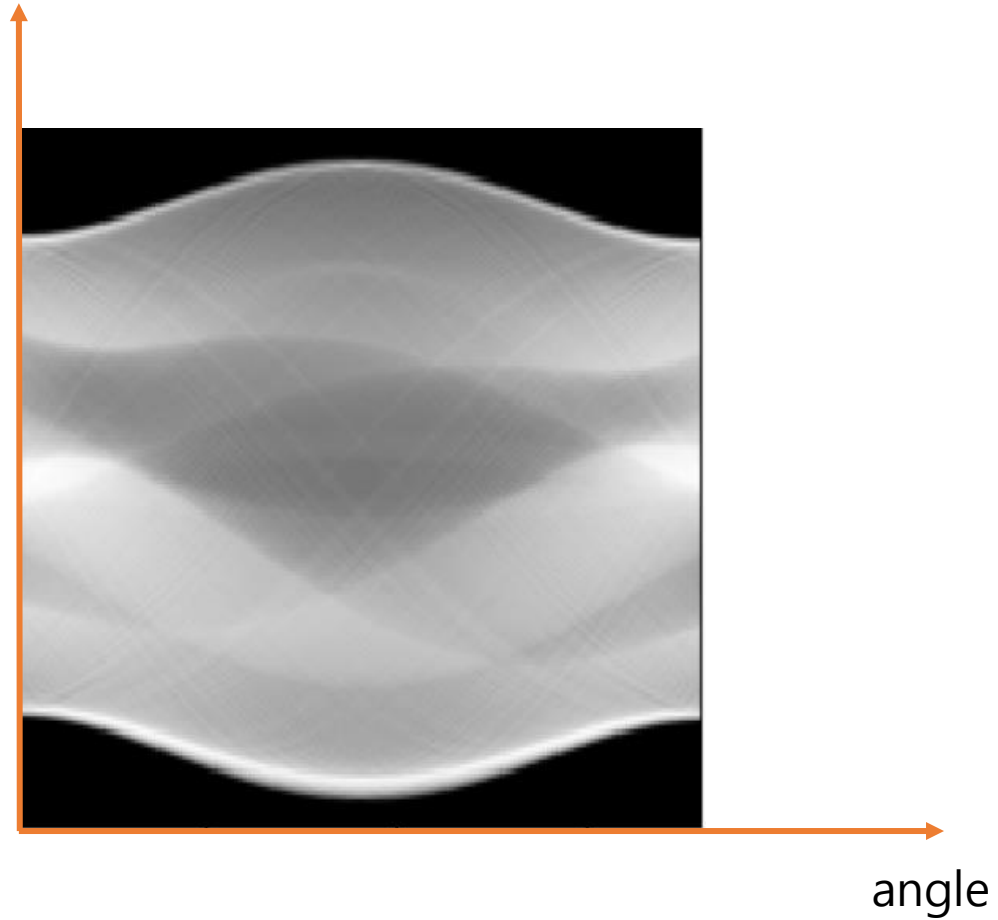
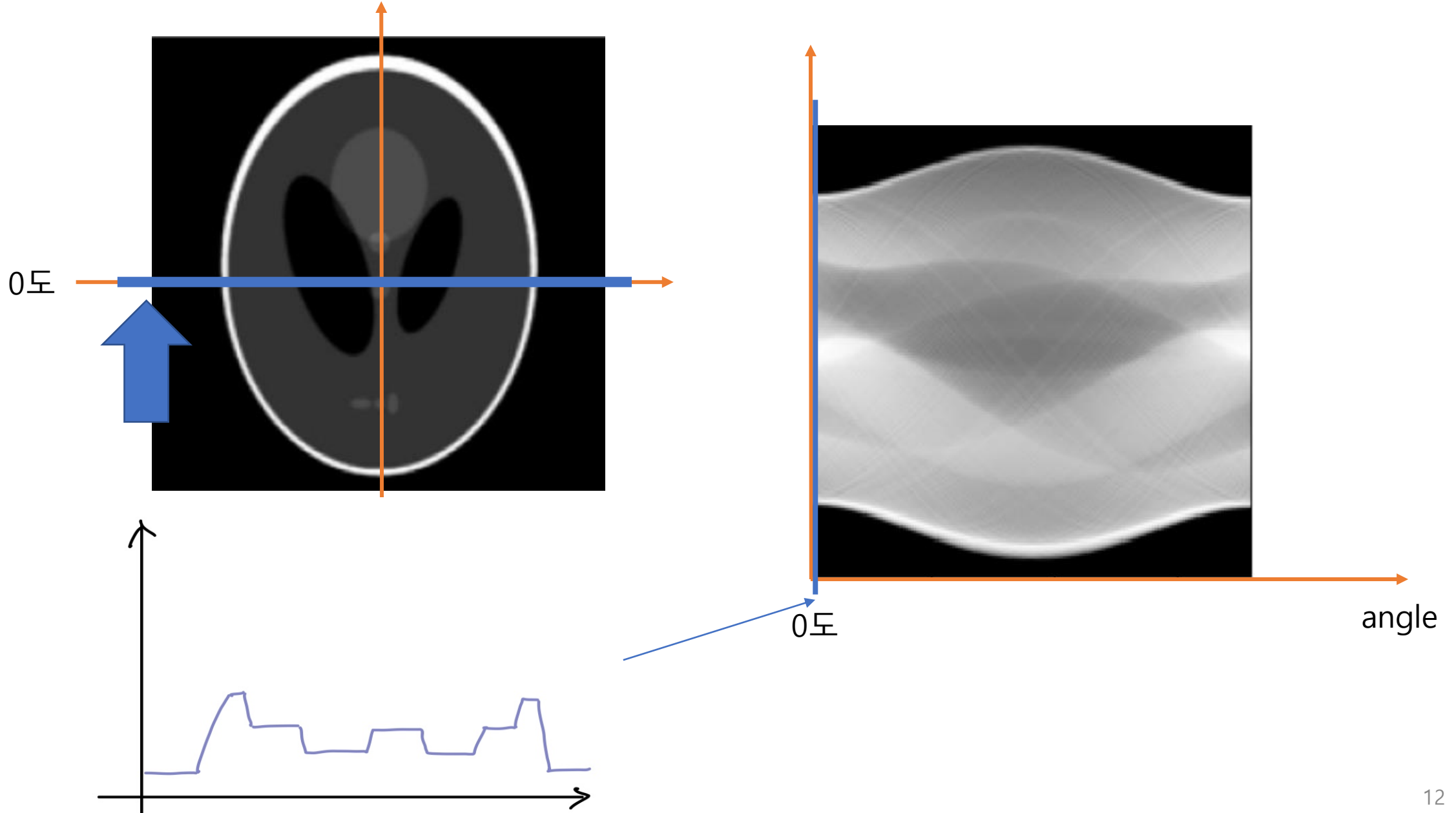


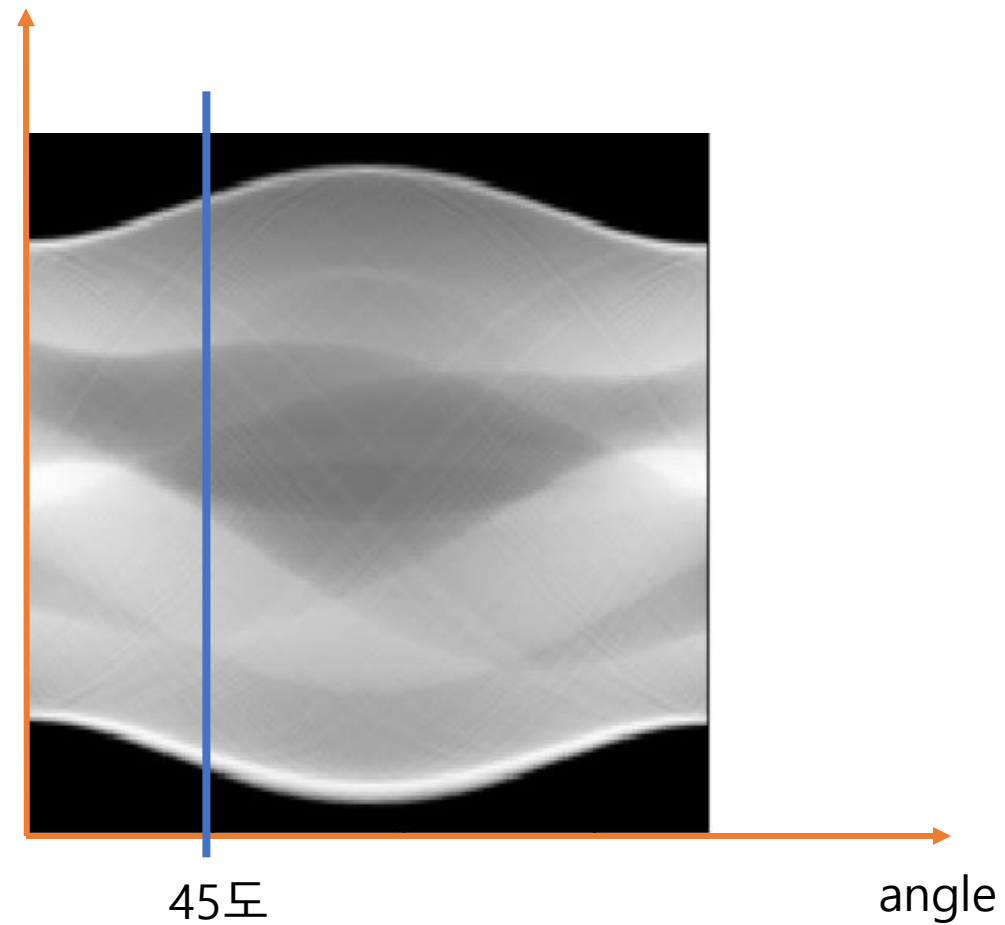
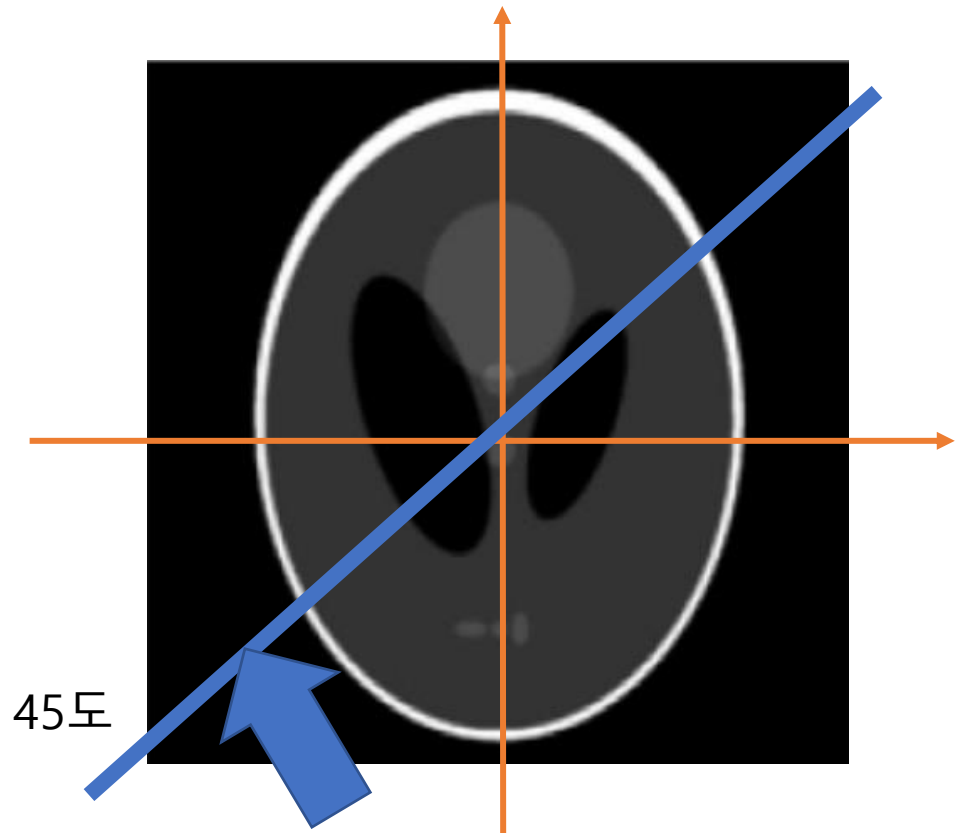
Figure 1
Radon Transform



3. radon transformation



3. radon transformation



4. search for periodicity

- resample → autocovariance sequences은 강한 주기성을 나타냄

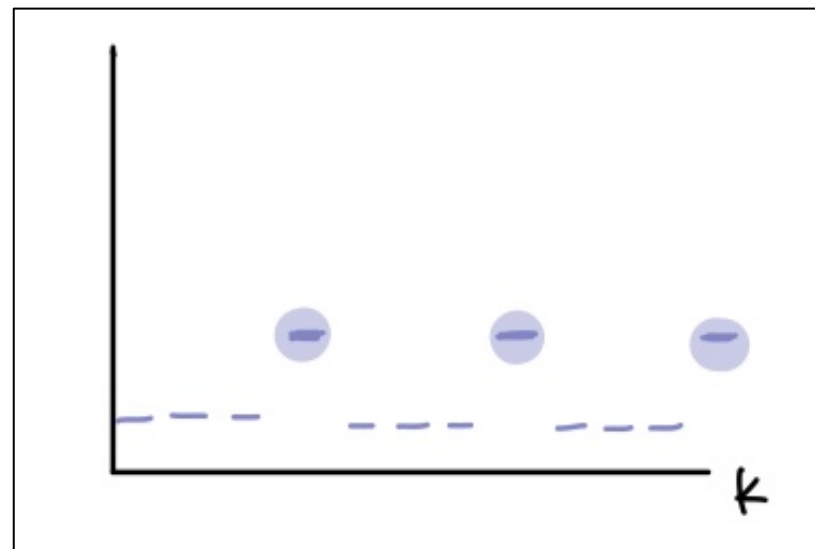
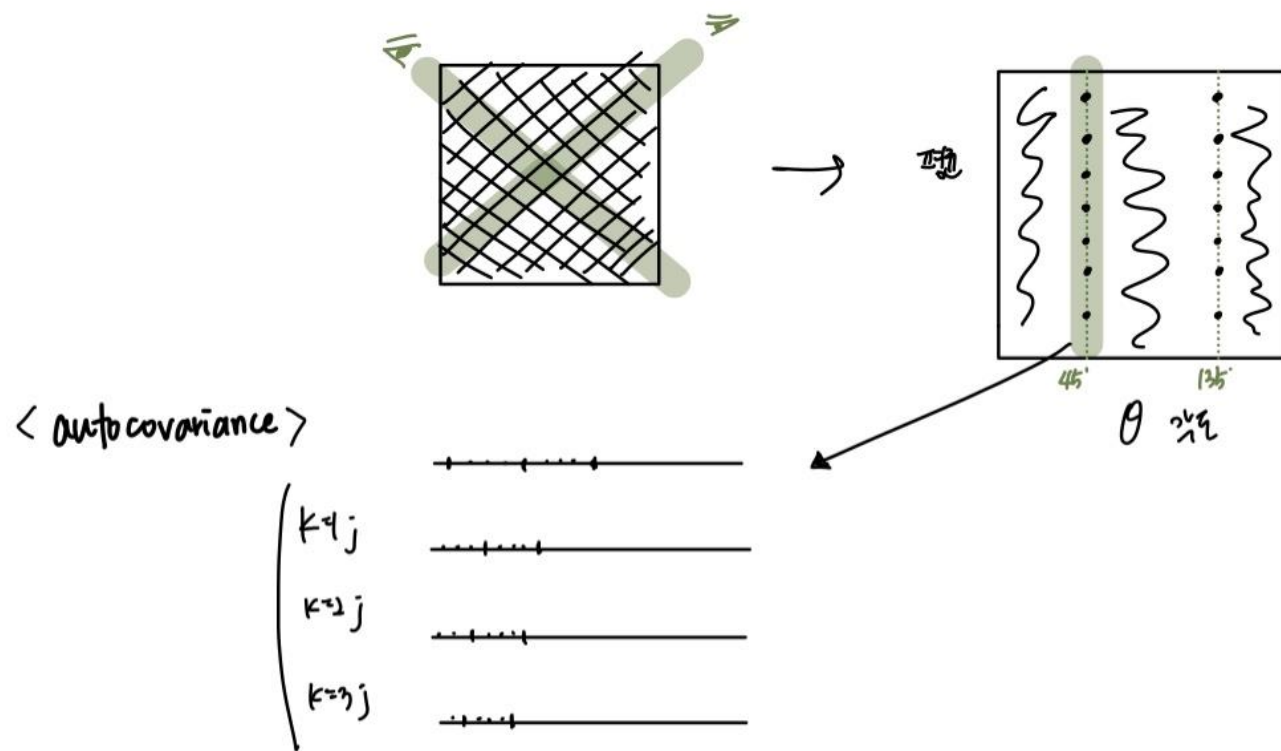
$$R_{\rho_{\theta}}(k) = \sum_i (\rho_{\theta}(i+k) - \overline{\rho_{\theta}}) (\rho_{\theta}(i) - \overline{\rho_{\theta}}).$$

- 주기성을 강조하고 더 쉽게 찾기 위해, derivative filter를 ρ_{θ} 에 적용
- 보간을 나타내는 강한 peak를 쉽게 나타내기 위해, $R_{\rho_{\theta}}$ 의 fast Fourier transformation(FFT)의 magnitude 계산
- 모두 결합하여 출력생성

4. search for periodicity

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