Data Science in fractional Fourier transform

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UIS

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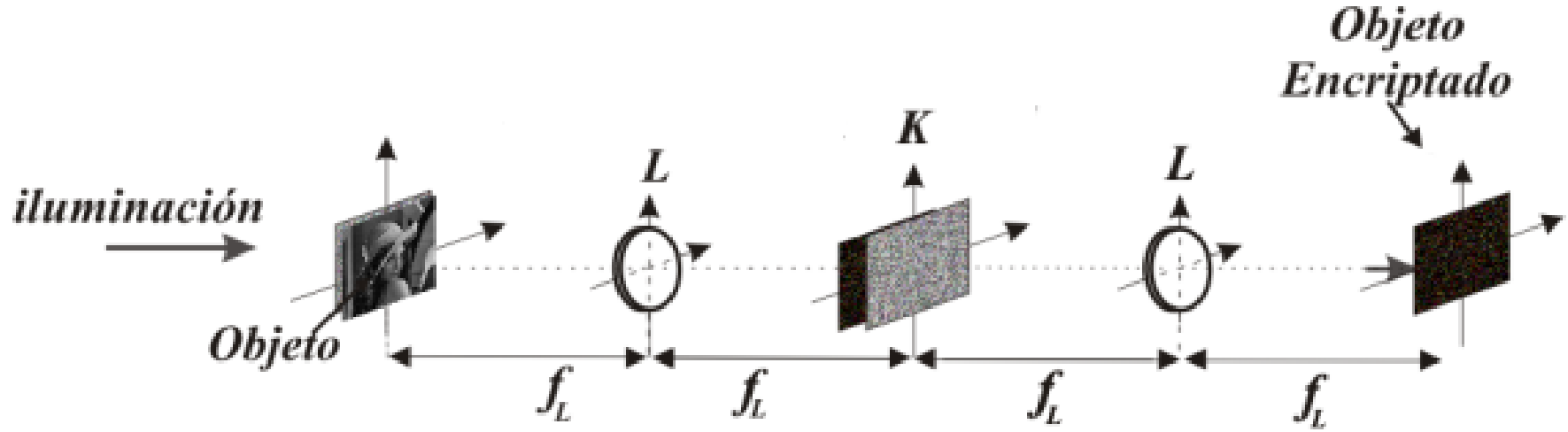
Fractional Fourier Transform

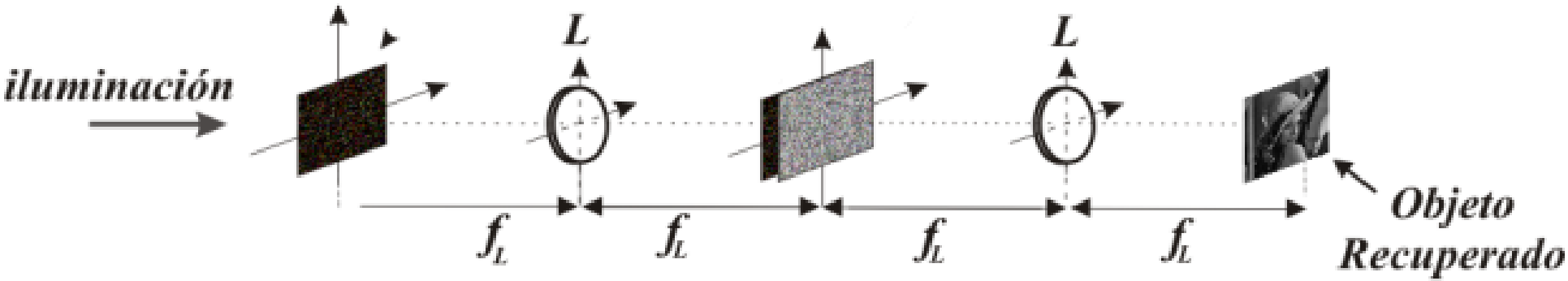
The fractional Fourier transform $\mathcal{F}^a$ of order $a \in \mathbb{R}$ is a linear integral operator that maps a given function (signal) $f(x), x \in \mathbb{R}$ onto $f_a(u), u \in \mathbb{R}$ by

$$f_a(u) = \mathcal{F}^a(f) = \int_{-\infty}^{+\infty} K_a(u', u) f(u') du'$$

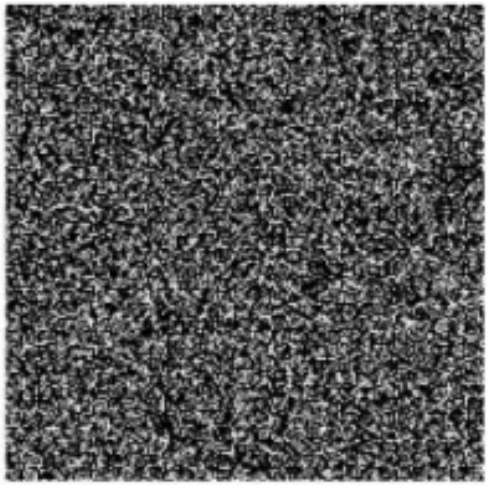
where the kernel is defined as follows. Set $\alpha = \dfrac{a\pi}{2}$ then

$$K_a(u, u') = A_\alpha \exp\{-\pi i \left(2 \csc \alpha u u' - (u - u')^2 \cot \alpha\right)\}$$


Objeto
Encriptado
iluminación
K
L
L
Objeto
f_L
f_L
f_L
f_L


iluminación
L
L
f_L
f_L
f_L
f_L
Objeto
Recuperado

(a)



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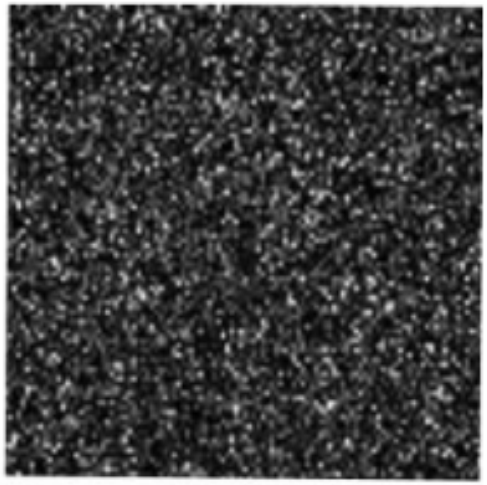
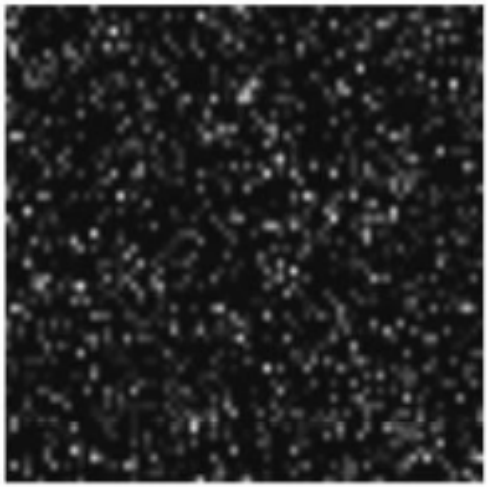


(c)



(d)

(e)

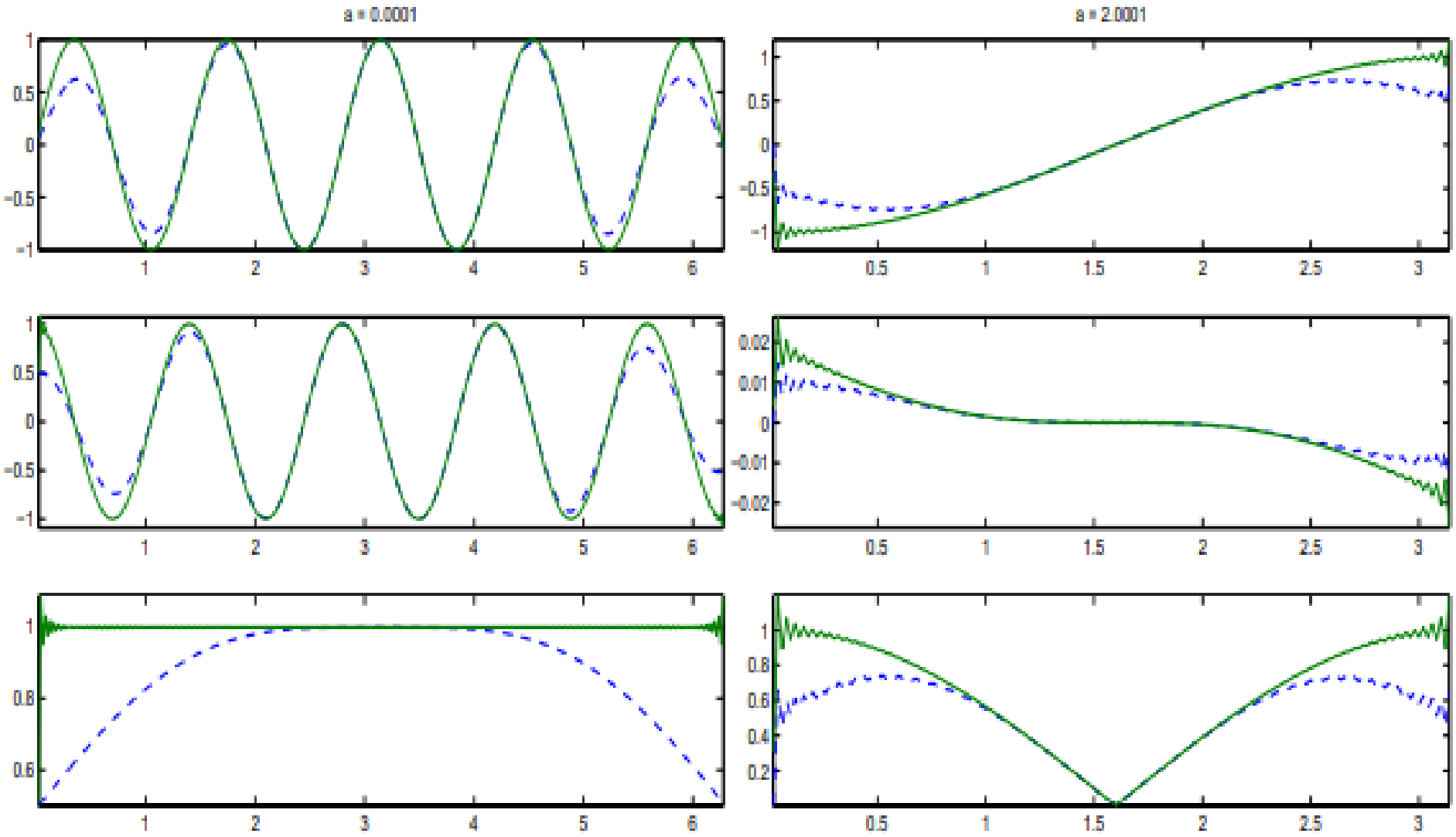
(a) Imagen original, (b) llave de seguridad (máscara aleatoria de fase), (c) imagen encriptada, (d) imagen desencriptada cuando se usa una llave distinta a la usada en la encriptación y (e) imagen desencriptada cuando se usa la llave adecuada

Contents

How to implement Data science

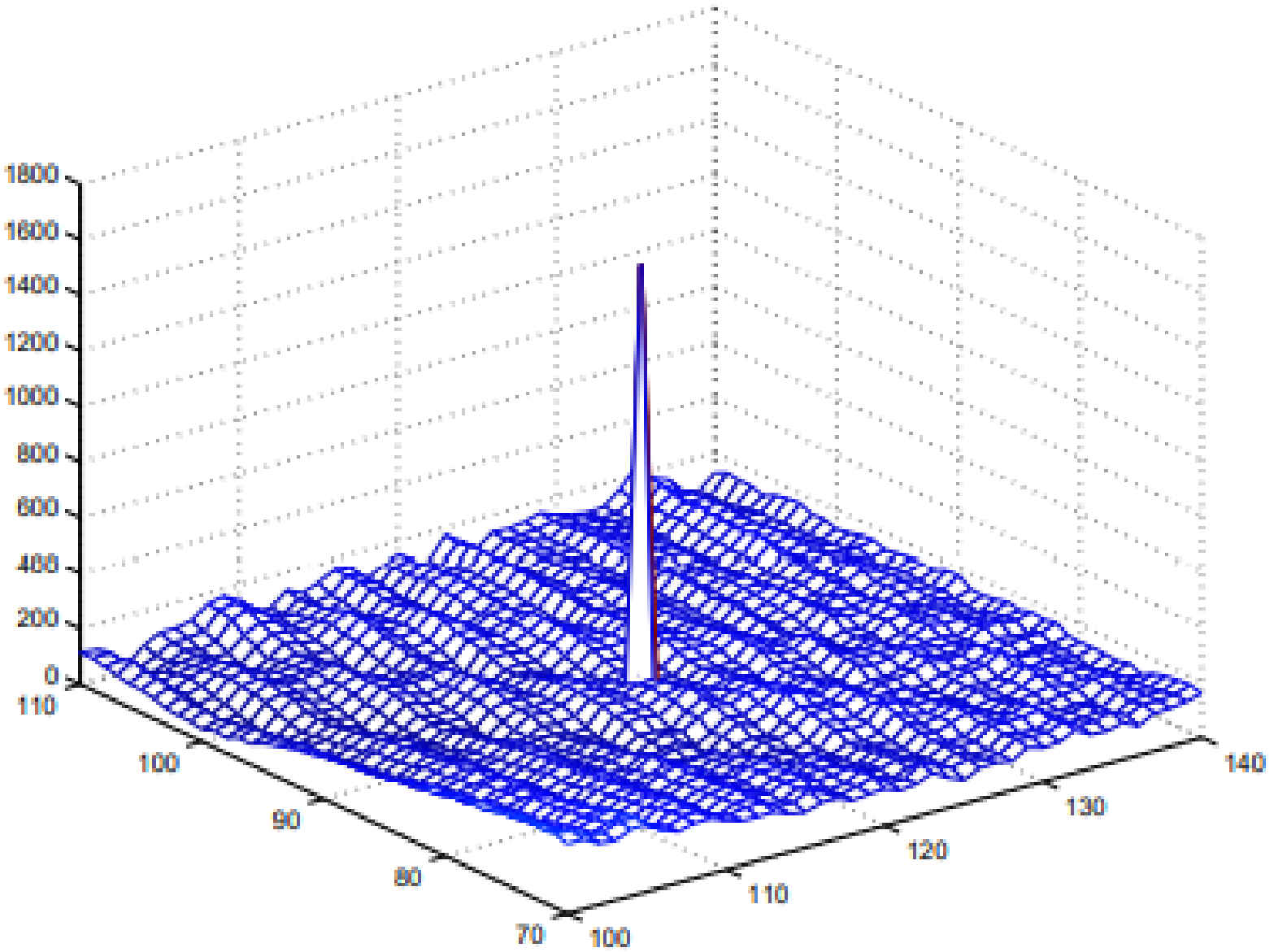
1. To find approximation algorithm: sinc interpolation and Lagrange interpolation.
2. Programming in matlab.
3. Librery:FTFAT (Large Time-Frequency Analysis Toolbox). Routines fracF and ffracft.

plotting



Two-dimension transform

Plotting with matlab



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Conclusion

1. Fractional Fourier transform as an option for information security
2. It's an instrument that illustrates, compares data and quickly approximates the construction of FRFT.
3. DS detects the concentration of chirp on an image and thus get a cleaner result.