Tarea2

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1 Proyecto 2: Propedéutico

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1.1 Parte 1: Teoría de Álgebra Lineal y Optimización

Necesito estudiar esta parte

1.2 Parte 2: Aplicaciones en Python

In [1]:
```
import numpy as np
from PIL import Image
import matplotlib.pyplot #import matplotlib.pyplot as plt

img = Image.open("tarea2.color.png")
img
```

Out[1]:

```
In [2]: img = img.convert("LA")
        row, col =  img.size
        data = np.zeros((row*col, 5))
        matplotlib.pyplot.figure(figsize=(9, 6))
        matplotlib.pyplot.imshow(img)
        img
```

Out[2]:

1.2.1 1. SVD

```
In [3]: A = np.matrix(img.getdata(band=0), float)
        A
```

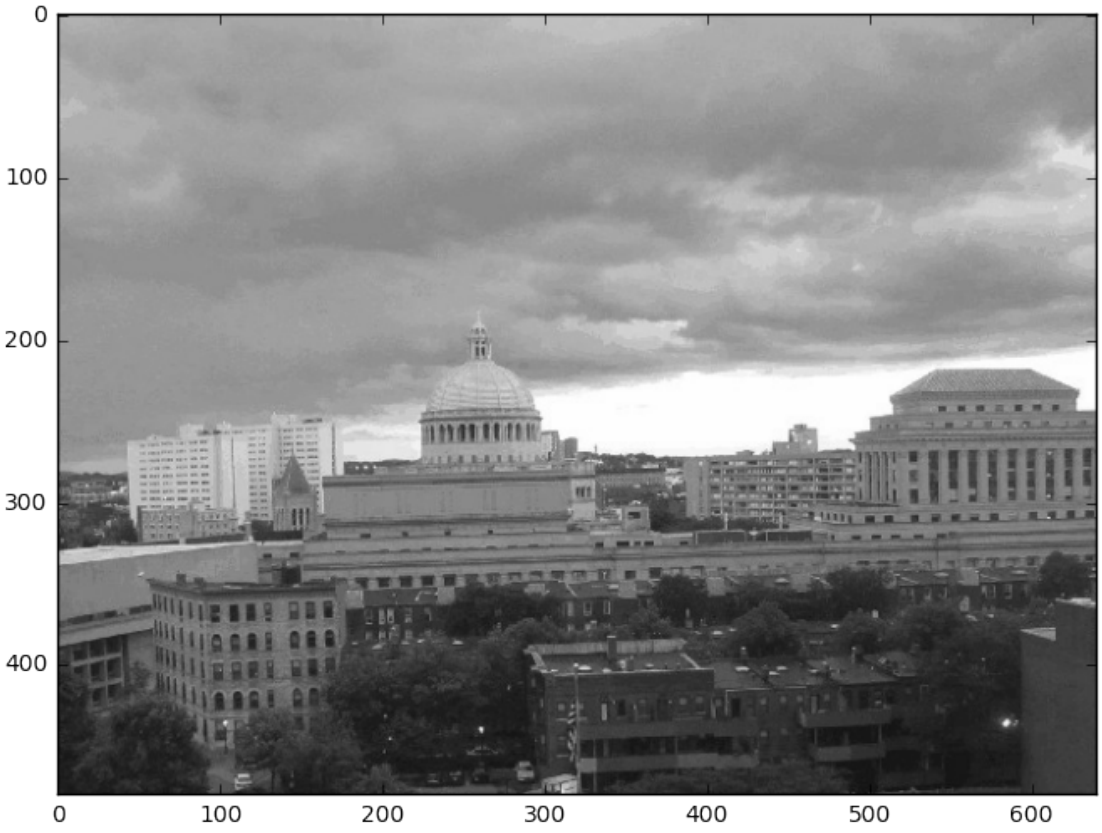
```
Out[3]: matrix([[ 171.,  180.,  176., ...,   64.,   65.,   63.]])
```

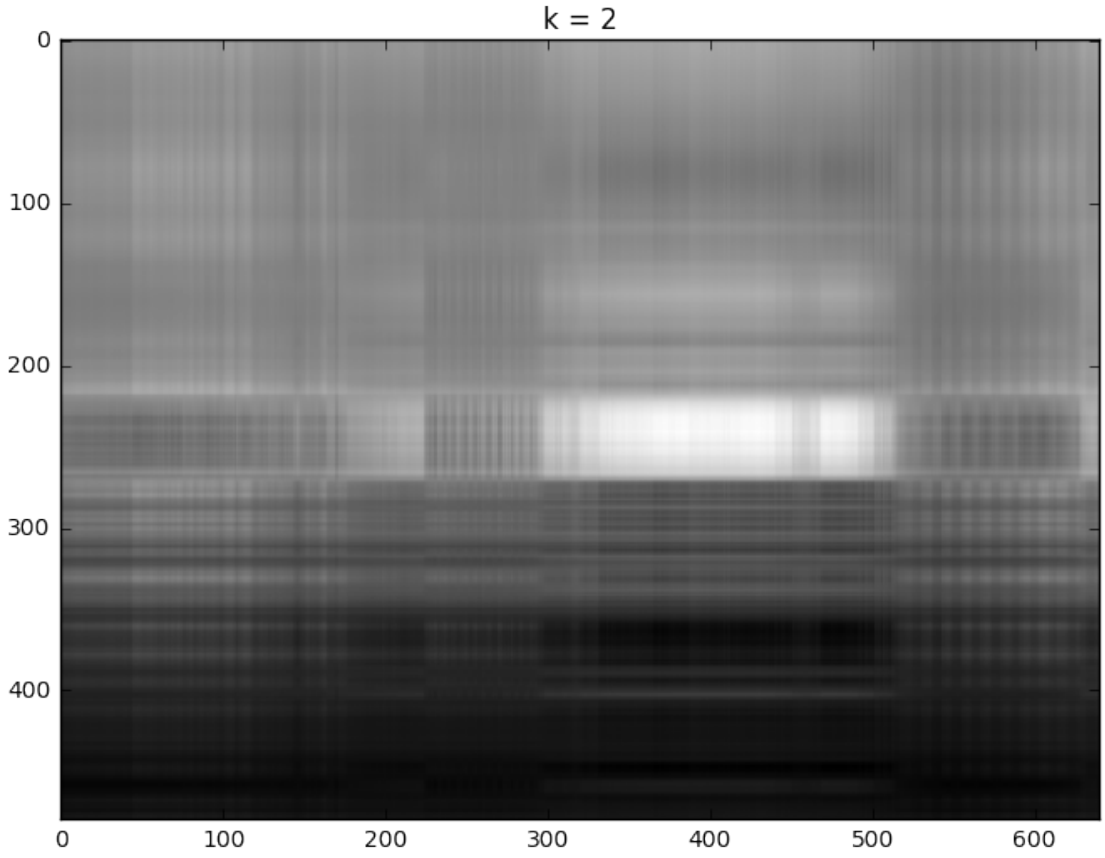
```
In [4]: A.shape = (img.size[1], img.size[0])
        A.size
```

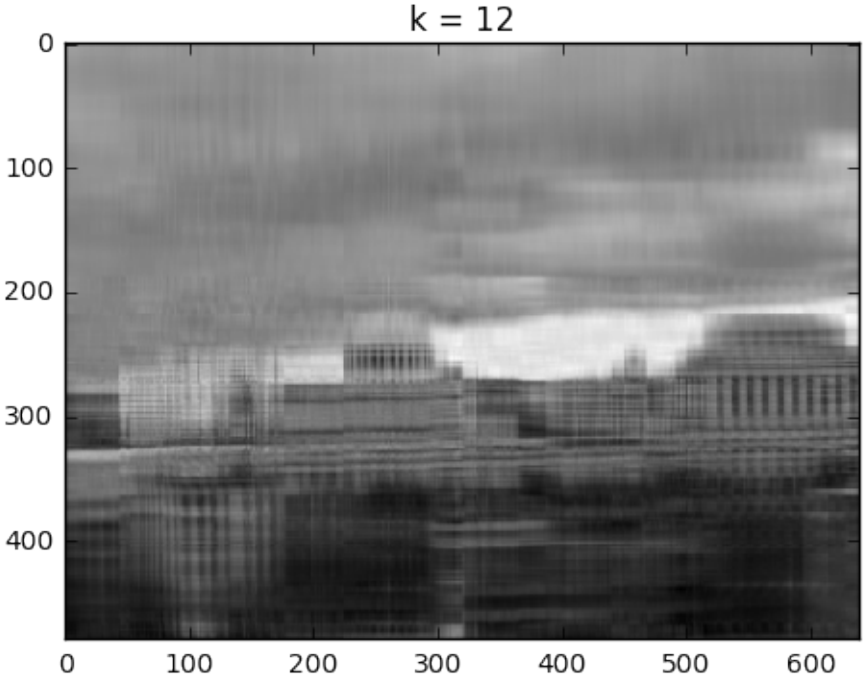
```
Out[4]: 307200
```

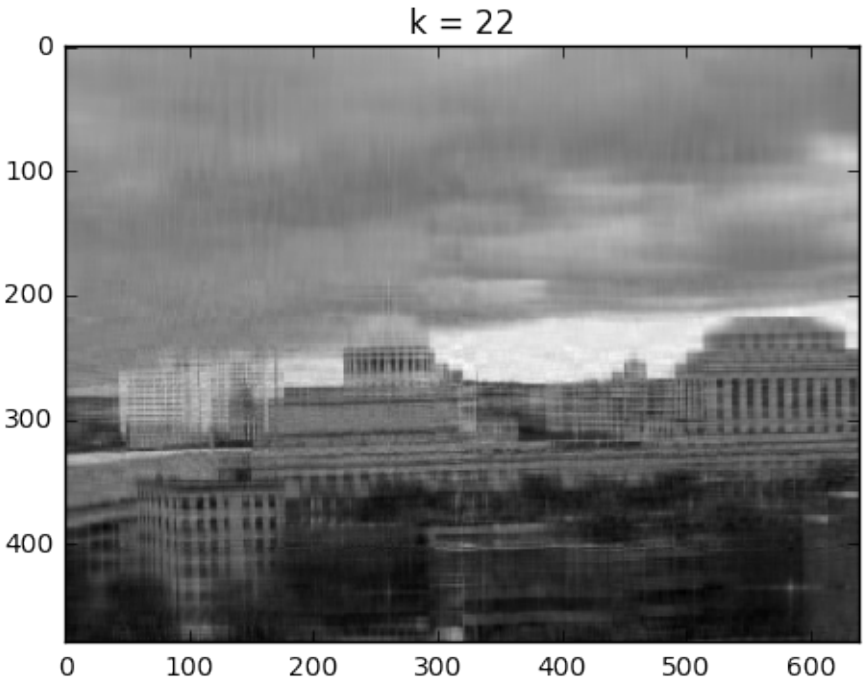
```
In [5]: u, s, v = np.linalg.svd(A, full_matrices=1)
```

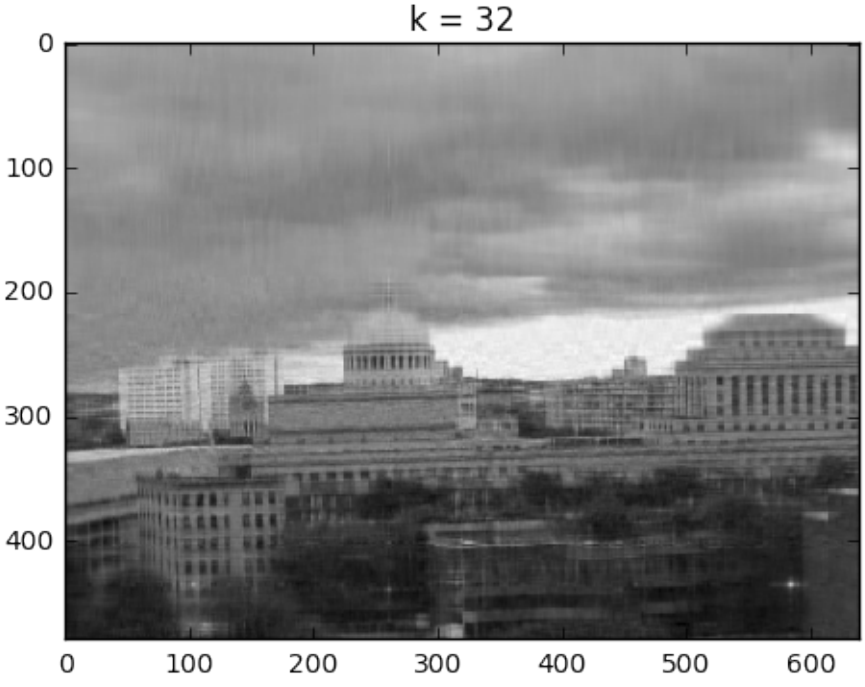
```
In [6]: matplotlib.pyplot.figure(figsize=(9,6))
        matplotlib.pyplot.imshow(img, cmap='gray')
        for k in range(2,100,10):
            B = np.matrix(u[:, :k]) * np.diag(s[:k]) * np.matrix(v[:k, :])
            matplotlib.pyplot.imshow(B, cmap='gray')
            matplotlib.pyplot.title("k = " + str(k))
            matplotlib.pyplot.show()
```

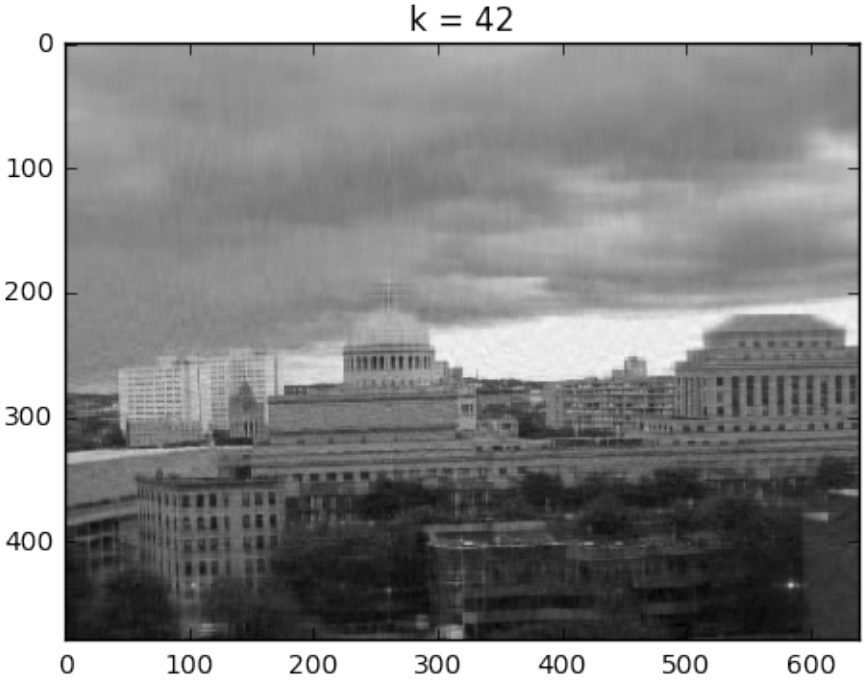

0
100
200
300
400
0
100
200
300
400
500
600

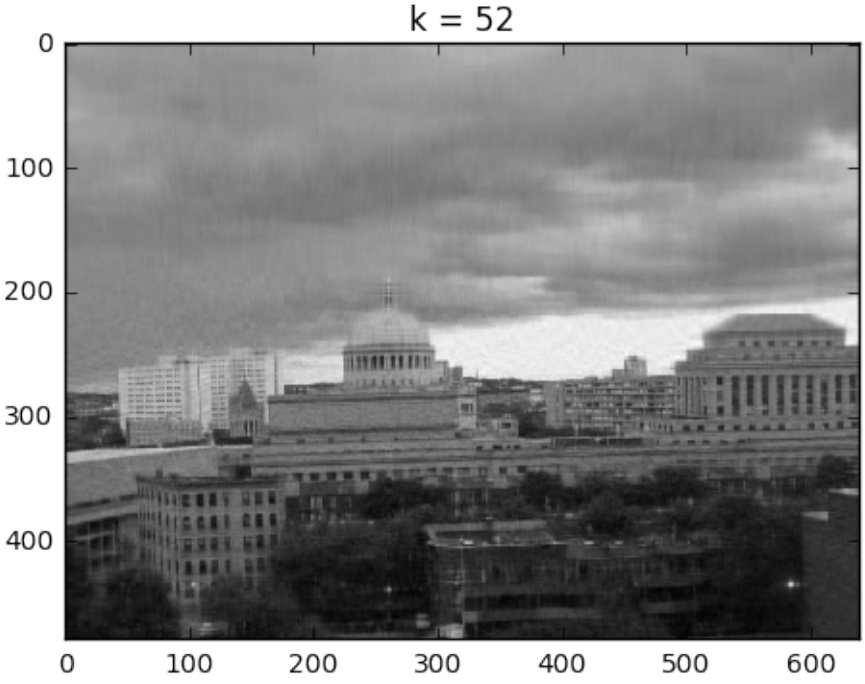

k = 2
0
100
200
300
400
0
100
200
300
400
500
600

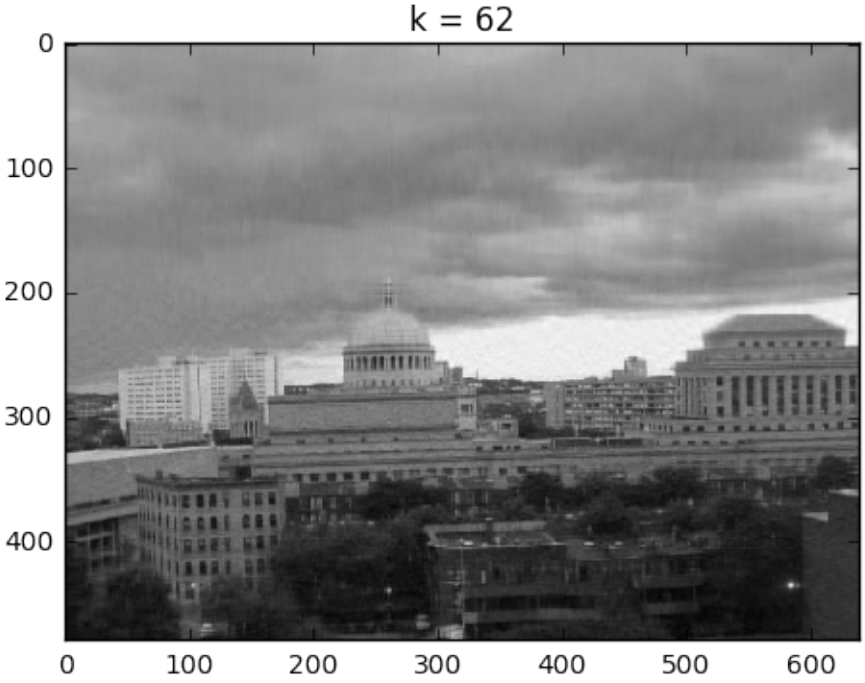

k = 12
0
100
200
300
400
0
100
200
300
400
500
600

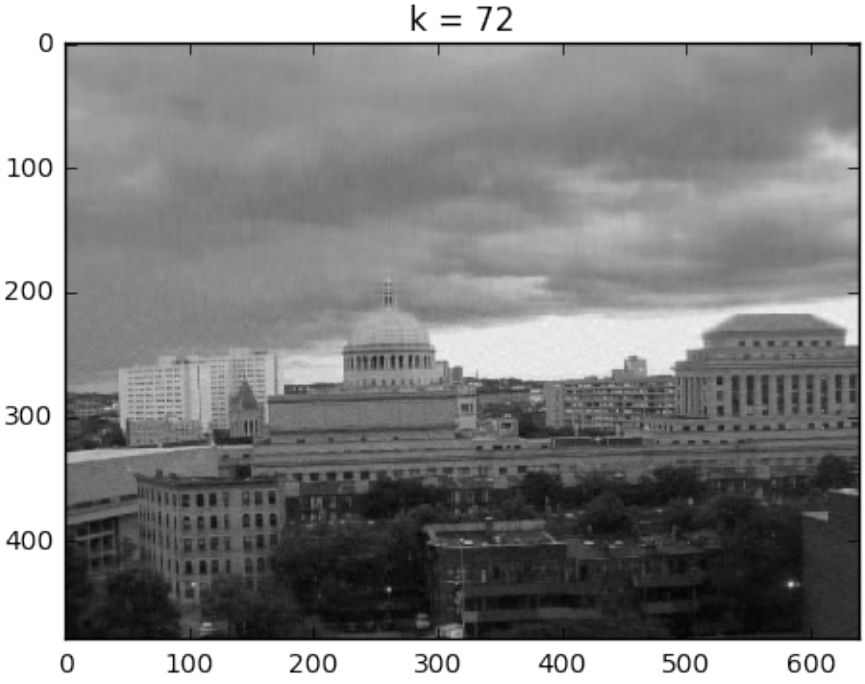

k = 22
0
100
200
300
400
0
100
200
300
400
500
600

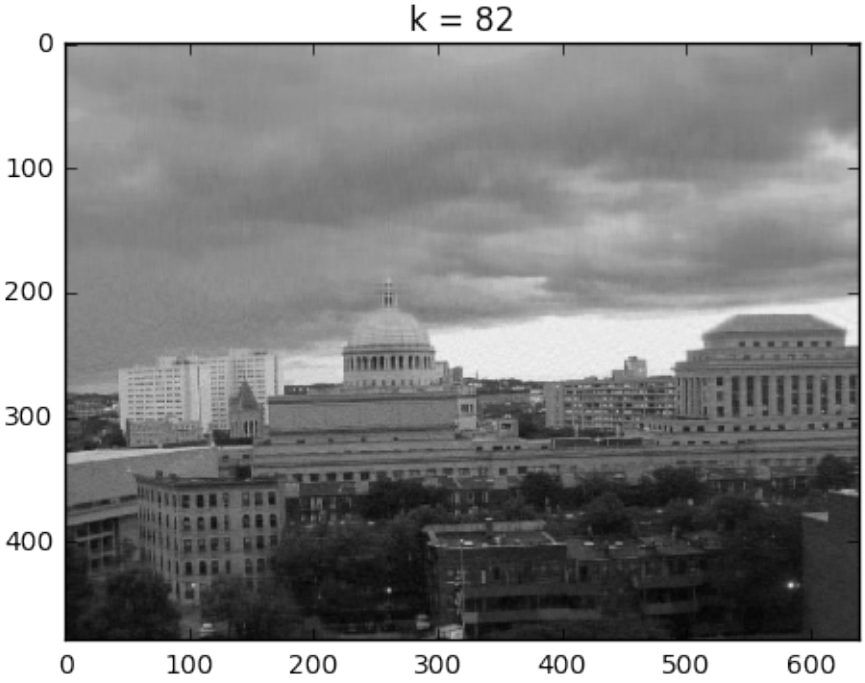

k = 32
0
100
200
300
400
0
100
200
300
400
500
600

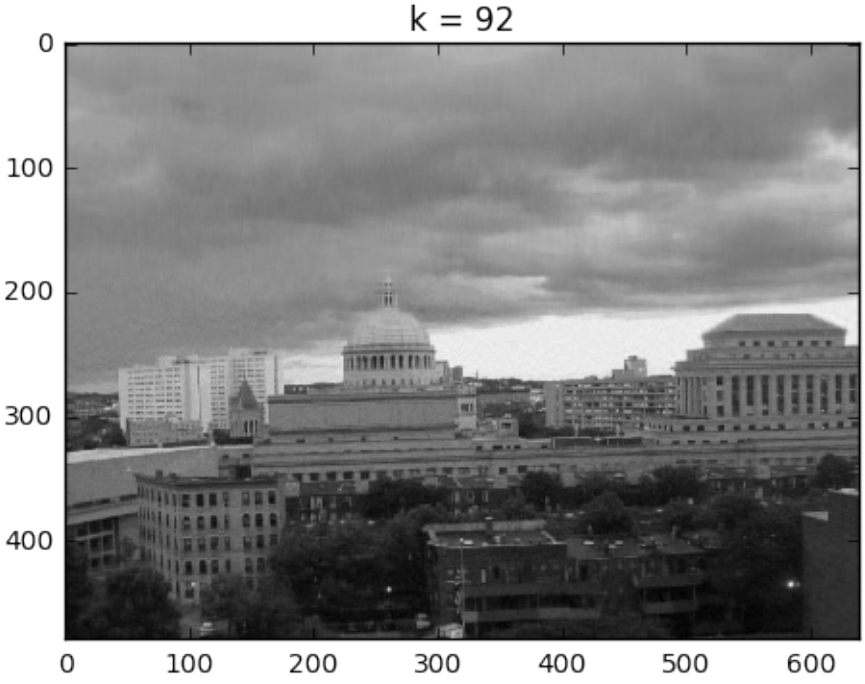

k = 42
0
100
200
300
400
0
100
200
300
400
500
600


k = 52
0
100
200
300
400
0
100
200
300
400
500
600


k = 62
0
100
200
300
400
0
100
200
300
400
500
600


k = 72
0
100
200
300
400
0
100
200
300
400
500
600


k = 82
0
100
200
300
400
0
100
200
300
400
500
600


k = 92
0
100
200
300
400
0
100
200
300
400
500
600

£Qué tiene que ver con la compresión de imágenes? Como se puede observar, muchos algoritmos utilizan la compresión a través de la operación SVD, pues reduce el número de columnas, renglones en una matriz y va reduciéndose de manera progresiva el número de renglones y en consecuencia del tamaño de archivos, por ende perdiendo calidad.

1.2.2 a. Pseudoinversa

```
In [7]: import numpy as np

        def pinversa(A):
            u, s, v = np.linalg.svd(A)
            B = np.dot(v.transpose(), np.dot(np.diag(s**-1), u.transpose()))
            B = v.transpose() * (np.diag(s**-1)*u.transpose())
            return np.array(B)

        A = np.matrix([[1,2,3],[4,5,6],[7,8,9]])
        C = np.matrix([[1,2],[4,5]])
        C = pinversa(C)
        C

Out[7]: array([[-1.66666667,  0.66666667],
               [ 1.33333333, -0.33333333]])
```

Se muestra como al aplicar la inversa nuevamente vuelve a su forma original

```
In [8]: np.linalg.pinv(C)

Out[8]: array([[ 1.,  2.],
               [ 4.,  5.]])
```

1.2.3 3. Pandas

```
In [15]: import pandas as pd
         import os
         import numpy as np
         import statsmodels.formula.api as sm

         studysat = pd.read_csv("study_vs_sat.csv")
         studysat = pd.DataFrame(studysat)
         studysat

Out[15]:     study_hours  sat_score
         0             4        390
         1             9        580
         2            10        650
         3            14        730
         4             4        410
         5             7        530
         6            12        600
```

```
7             22        790
8              1        350
9              3        400
10             8        590
11            11        640
12             5        450
13             6        520
14            10        690
15            11        690
16            16        770
17            13        700
18            13        730
19            10        640
```

```
In [28]: modelo = sm.ols("study_hours ~ sat_score", studysat)
         modelo = modelo.fit()
         modelo.params
```

```
Out[28]: Intercept   -10.941095
         sat_score     0.034415
         dtype: float64
```

```
In [35]: sumhours = sum(studysat["study_hours"])
         sumsat = sum(studysat["sat_score"])
         sumhourssat = sum(studysat["study_hours"] * studysat["sat_score"])
         sumhours2 = sum(studysat["study_hours"]**2)
         sumsat2 = sum(studysat["sat_score"]**2)
         length = len(studysat["study_hours"])
          = (length * sumhourssat - sumhours*sumsat)/(length * sumhours2 - sumhours**2)
```

```
Out[35]: 25.326467777895743
```

```
In [36]:  = sumsat / length - (*sumhours) / length
```

```
Out[36]: 353.16487949888523
```