In [95]:
```python
# Following lines are for Python 2.x to 3.xx compatibility
from __future__ import print_function
from __future__ import division
```

In [96]:
```python
#IMPORT
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
%matplotlib inline

## Set a seed for the random number generator
np.random.seed(100)
```

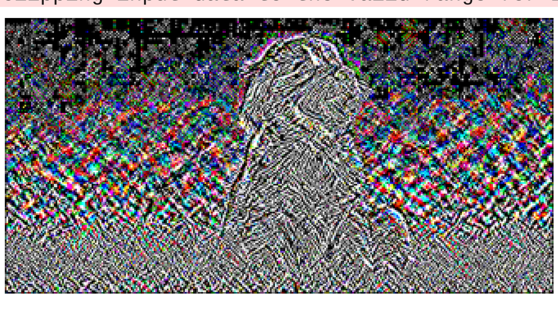
Problem 2

In [97]:
```python
myRGB = mpimg.imread("./images/pup.jpg")

plt.axis('off')
plt.imshow(myRGB)
plt.show()
```

In [98]:
```python
# Part A: Pad the image by 10 pixels of your liking on all sides.
bt = 10  # pad width
r_cons, g_cons, b_cons = [0, 0, 255] # color for pad: blue

r_, g_, b_ = myRGB[:, :, 0], myRGB[:, :, 1], myRGB[:, :, 2]

rb = np.pad(array=r_, pad_width=bt, mode='constant', constant_values=r_cons)
gb = np.pad(array=g_, pad_width=bt, mode='constant', constant_values=g_cons)
bb = np.pad(array=b_, pad_width=bt, mode='constant', constant_values=b_cons)

image_b = np.dstack(tup=(rb, gb, bb))

plt.axis('off')
plt.imshow(image_b)
plt.show()
```

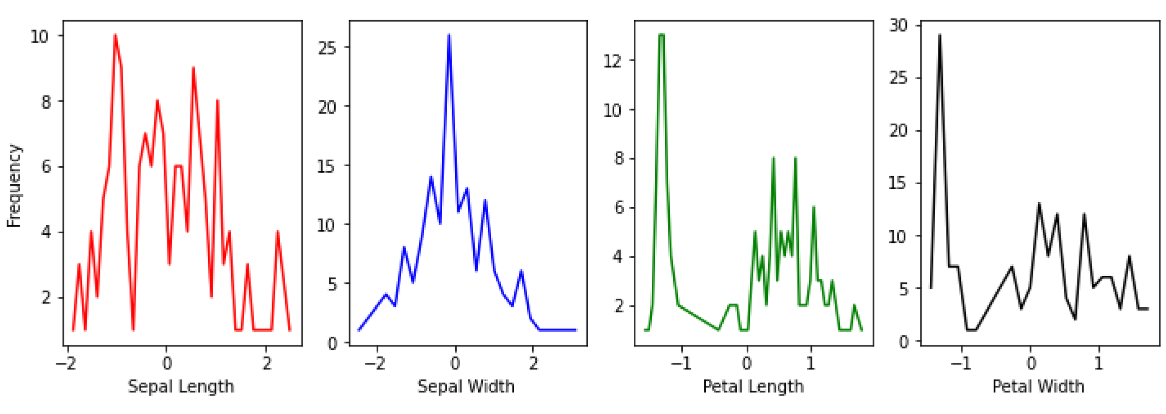
In [119…
```python
# Part B; perform an operation called convolution on the original image, using window 3x3 kernal

K=np.array([[1, 0, -1],[0, 0, 0],[-1, 0, 1]]) # 1st type of kernal
#K = np.array([[0, -1, 0], [-1, 4, -1], [0, -1, 0]]) #2nd type of kernal

img_h = myRGB.shape[0]
img_w = myRGB.shape[1]

ker_h = K.shape[0]
ker_w = K.shape[1]

h = ker_h//2
w = ker_w//2

myRGB_conv = np.zeros(myRGB.shape)

for i in range(h, img_h-h):
    for j in range(w, img_w-w):
        sum = 0

        for m in range(ker_h):
            for n in range(ker_w):
                sum = sum + K[m][n]*myRGB[i-h+m][j-w+n]

        myRGB_conv[i][j] = sum


plt.axis('off')
plt.imshow(myRGB_conv)
plt.show()
```

```
Clipping input data to the valid range for imshow with RGB data ([0..1] for floats or [0..255] for integers).
```



Problem 3

In [223…
```python
# Find the z-scoring (z  = (x - x_mean)/std)

from sklearn import datasets

iris = datasets.load_iris().data

iris_mean = np.mean(iris, axis=0)# finding means of each datatype, there are 4 types

#print(iris_mean)

iris_std = np.std(iris, axis=0) # finding the std for each type of data

#print(iris_std)

iris_z_score = np.divide(np.subtract(iris, iris_mean), iris_std) # calculating z score

#print(iris_z_score)

#finding frequencies of z scores
(uni_sl, c_sl) = np.unique(iris_z_score[:, 0], return_counts=True)
f_sl = np.asarray((uni_sl, c_sl)).T
(uni_sw, c_sw) = np.unique(iris_z_score[:, 1], return_counts=True)
f_sw = np.asarray((uni_sw, c_sw)).T
(uni_pl, c_pl) = np.unique(iris_z_score[:, 2], return_counts=True)
f_pl = np.asarray((uni_pl, c_pl)).T
(uni_pw, c_pw) = np.unique(iris_z_score[:, 3], return_counts=True)
f_pw = np.asarray((uni_pw, c_pw)).T

# ploting the z-scores vs the frequencies

plt.figure(figsize=(12, 8))
plt.subplot(241)
plt.plot(f_sl[:, 0], f_sl[:, 1], 'r' )
plt.xlabel('Sepal Length')
plt.ylabel('Frequency')

plt.subplot(242)
plt.plot(f_sw[:, 0], f_sw[:, 1], 'b' )
plt.xlabel('Sepal Width')

plt.subplot(243)
plt.plot(f_pl[:, 0], f_pl[:, 1], 'g' )
plt.xlabel('Petal Length')

plt.subplot(244)
plt.plot(f_pw[:, 0], f_pw[:, 1], 'k' )
plt.xlabel('Petal Width')
plt.show()
```



Problem 4

In [192…
```python
# the following code is from the class notes --------------------------------------------------
from sklearn.feature_extraction.text import CountVectorizer,ENGLISH_STOP_WORDS

vectorizer = CountVectorizer()

document1 = " I bought this game as a gift for my 8 year old daughter who loves games. I was expecting lots of gross foods--but I was surprised at the inappro
document2 = "Absolutely love Taco vs burrito. I bought it as a kickstarter. I originally bought this game because my husband and I love to play games with fri
document3 = " Unlike several of the reviewers here, I didn't purchase this originally for when kids are around. I bought it because of the reviews that said t
doc_list = [document1, document2, document3]

bow = vectorizer.fit_transform(doc_list)
#print(type(bow))
#print ("Feature (terms) Names: \n",vectorizer.get_feature_names())

# Check the matrix
#print("Bag of words sparse matrix (data structure CSR-compressed sparse row):\n",bow, "\n To an array: \n", bow.toarray())

# Starting new code ---------------------------------------------------------------------------
# The print statements include were for double checking work and if needed for curiousity to see step by step results
doc_term = bow.toarray()
(row, col) = np.shape(doc_term) #(dim: row, col)

#print(doc_term)
doc_sum = np.sum(doc_term, axis=1, keepdims=True) # sum each row, keep as column vector (dim: row, 1)

#print(doc_sum)

doc_term_freq = np.divide(doc_term, doc_sum) # divide each row by sum of the row,  (row, col)/(row, 1)

#print(doc_term_freq[0, :])
#print(np.divide(doc_term[0, :], sum_d1))

term_count = np.count_nonzero(doc_term, axis=0) # count how many docs include each term (dim: 1, col)

#print(term_count)

idf = np.subtract(np.log(row), np.log(term_count)) # natural log of num of docs(row) - natural log of the term count

#print(idf)

tf_idf = np.multiply(np.reshape(doc_term_freq, (col, row)), np.reshape(idf, (col, 1))) # freq*idf dim result: (col, row)
tf_idf = tf_idf.T #swtich back to (row, col)

print(tf_idf)

# visual below of how the tf_idf looks based on the frequencies of each terms tf_idf
(uni, c) = np.unique(tf_idf, return_counts=True)
freq = np.asarray((uni, c))

plt.plot(freq[0, :], freq[1, :], 'b' )
plt.xlabel('Term tf_idf')
plt.ylabel('Frequency')
```

```
[[0.         0.         0.01168736 0.         0.         0.
  0.         0.01168736 0.         0.04674946 0.         0.01168736
  0.         0.01168736 0.00862692 0.         0.01168736 0.
  0.         0.         0.         0.01168736 0.01168736 0.
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  0.         0.00431346 0.01077071 0.01077071 0.02154142 0.
  0.01077071 0.01077071 0.03231213 0.         0.         0.
  0.01077071 0.         0.01077071 0.         0.         0.03231213
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  0.         0.05385354 0.01077071 0.         0.         0.
  0.01077071 0.02154142 0.         0.01077071 0.         0.01077071
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  0.         0.01077071 0.         0.01192544 0.05385354 0.
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  0.03543911 0.01771955 0.         0.         0.01771955 0.
  0.01771955 0.         0.         0.         0.         0.
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  0.         0.         0.         0.         0.         0.
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  0.03543911 0.         0.01771955 0.         0.         0.
  0.         0.         0.01771955 0.         0.00653976 0.00653976
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  0.0079503  0.         0.         0.         0.         0.01771955
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  0.         0.         0.         0.         0.         0.00653976
  0.01771955 0.         0.         0.         0.         0.
  0.00653976 0.         0.         0.01771955 0.01771955 0.01771955
  0.         0.         0.         0.08859777 0.         0.
  0.         0.         0.         0.         0.         0.        ]]
```

Out[192… Text(0, 0.5, 'Frequency')