Assignment 4 - Keyboard Analysis

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1 Introduction

The goal of this assignment is to create a Python program that analyzes keyboard usage patterns for a given text input, generates a heatmap of key usage, and calculates the total distance traveled by fingers while typing.

2 Code and Logic Explanation

The QWERTY layout used is a modified version of the layout given in the problem statement. There are two parts to the problem statement: the first is to calculate the distance traveled while typing an input text and then to generate a heatmap visualization of key usage.

2.1 Distance Calculation

The function `calc_dist` uses the Euclidean distance formula for calculating the distance between the home row key and the key typed. The challenge here is to find out which key in the home row is the starting point. The finger used to type the input key should be the finger placed initially on that home key whose distance from the input key is minimum. To find the home key, we calculate the distance of a particular key from all the keys in the home row and then identify the key with the minimum distance.

In the case of uppercase characters, the Shift key is assumed to be pressed along with the alphabet key. The `characters` dictionary stores the characters and the keys that need to be pressed to type that character. The `key_dict` is a dictionary which contains the keys and the values as their coordinates. This is done because it is difficult to access the coordinates of the keys directly from the `QWERTY_LAYOUT`.

2.2 Heatmap Generation

The `draw_key` function draws the keyboard layout using the Matplotlib library based on the coordinate system. The `normalize` function transforms the frequency values to a range of [0, 1], linking each key's color to its relative frequency, ensuring that higher frequencies correspond to more intense colors. The `counter` function returns the frequency of a character in the input text. The `create_heatmap` function creates a color mapping system using the normalize function to scale key frequencies between 0 and 1. It then iterates through the main keys, plotting each with a color that corresponds to its frequency using the `draw_key` function.

3 Results

Sample Text 1:

Artificial Intelligence (AI) and Machine Learning (ML) are transformative technologies reshaping various industries. AI encompasses systems that simulate human intelligence, enabling machines to perform tasks such as reasoning, learning, and problem-solving. Within AI, ML focuses on algorithms that allow computers to learn from data and improve their performance over time without explicit programming. This capability drives innovations in fields like healthcare, finance, and autonomous vehicles, where predictive analytics and

pattern recognition enhance decision-making and efficiency. As AI and ML continue to evolve, they promise to unlock new opportunities and challenges, influencing the future of technology and society.

Distance traveled in the QWERTY layout with modified coordinates = 767.97589788752

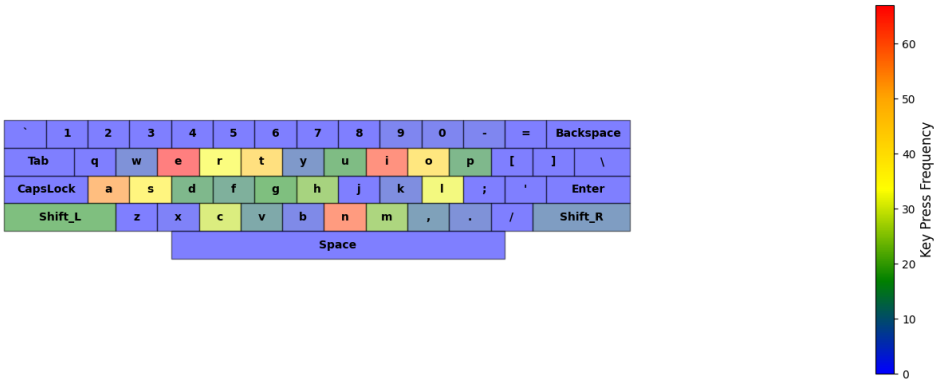

Figure 1: Heatmap of keyboard usage for Sample Text 1.

Sample Text 2:

Python is a versatile, high-level programming language known for its simplicity and readability, making it an ideal choice for both beginners and experienced developers. Released in the early 1990s, Python supports multiple programming paradigms, including procedural, object-oriented, and functional programming. Its extensive standard library and rich ecosystem of third-party packages enable rapid development across various domains, such as web development, data analysis, artificial intelligence, and automation. Python's active community contributes to continuous enhancements and extensive documentation, facilitating learning and collaboration. Its wide adoption in academia and industry underscores Python's role as a powerful tool for innovation and problem-solving.

Distance traveled in the QWERTY layout with modified coordinates = 764.763361909045

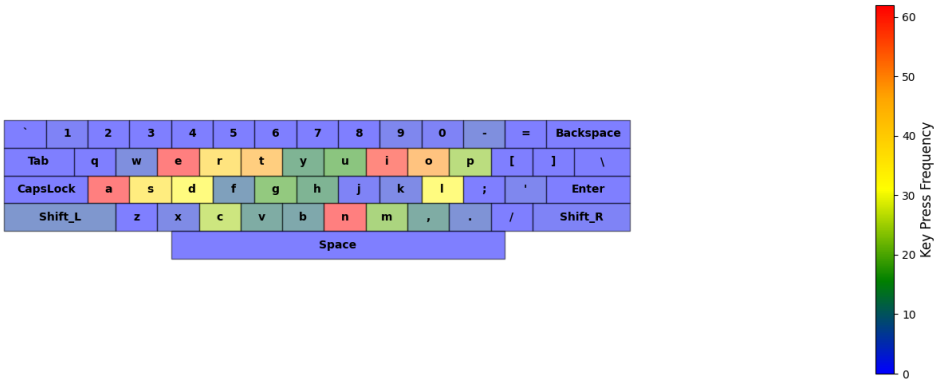

Figure 2: Heatmap of keyboard usage for Sample Text 2.

4 Note :

The code takes a string as input and gives the calculated distance and the heatmap (saved as hmap.png) for the QWERTY layout with modified coordinates as the output.