To give an example: If we wanted to type the word “universe”

An important note to make here is that the model is trained on the keystroke dynamics of one user only. RI finger to type “u”. When I press RI finger in upper layer. It gives several inputs to the system as shown below:

Readings are coming in this format : finger bending\_measurement

4 601

4 589

4 602

4 608

4 602

END

Here 4 represents Right hand Index finger. Once user pick up pressed finger, one “END” string passes which indicates to stop taking input. Now, take average of all bending measurement values till END comes. For the above values average of bending measurement is 600.4. Further this value will be searched in Matrix L (table#) in respective column as described in the process. This process gives us information about layer that that would be “U” - Upper layer for this example.

Now, we have two parameters, one is layer - “U” and finger- “RI”. This two parameters will be further used to find probable set of characters from Matrix F(table#). This process will give us set of alphabets. In our example we will get (“u” : 14, “y” : 11, “i”:1). As we have only one set of alphabet, rather than making combinations from sets of alphabets system directly starts finding words which starts with “u”, “y” and “i”.

Finger Record : ['RI']

Probability set : [('y', 14.0), ('u', 11.0), ('i', 1.0)]

Possible words : ['you', 'your', 'yet', 'young'....'us', 'up', 'upon', 'use',...'in', 'is', 'it', 'if',....'inanimate', 'interchange']

This words are already sorted based on its frequency.

Now system will wait for second input from user. To continue typing second alphabet ‘n’ I used RI finger in lower layer. The system inputs would be:

4 815

4 800

4 798

4 802

END

Here again user used finger 4 which denotes Right hand Index finger. Average value of all bending measurements before END comes would be 803.75. This average value will be searched in Matrix L’s Right hand Index columns. This search result will give us outpus “L” which denotes lower layer. For second keystroke acivity, system passes finger RI and layer L to Matrix F and gets second set of alphabet (“n” : 24, “b” : 11).   
  
Probability set : [('n', 24.0), ('b', 11.0)]

Now making combination from both alphabets sets, we will get combination set as shown below:

All possible combinations : ['yn', 'yb', 'un', 'ub', 'in', 'ib']

This all possible combinations will further check in transition matrix to verify whether this combination exist in any english word or not. Unreal combinations will get discart from possible combinations and it will make set of valid combination.

Validated combinations : ['yn', 'yb', 'un', 'ub', 'in', 'ib']

‘yn’ presents in word ‘sync’

‘yb’ presents in word ‘hybrid’  
Possible words will be derived from given combination.

Possible words : ['unto', 'under', 'uncle', 'understand',...'insultment', 'ibat', 'ibm', 'ibiblio']

Again system will wait for further inputs. Let’s say inputs are as shown below:

5 559

5 552

5 558

5 552

END

Again input finger is 5 which denotes Right hand Middle finger. Average of all bending measurements are 555.25. Now this average will be searched in Martix L. As this average is not falling in any minimum - maximum range of that finger. It will find nearest range of minimum - maximum. In our example 555.25 is nearest to 730-588 range and this range denotes upper layer. So this process will give output “U” - upper layer. As per algorithm process, layer value(U) and finger value(RM) will be used to get set of alphabets from Matrix F. Output of this process will be shown below:

Probability set : [('i', 29.0), ('o', 10.0), ('u', 5.0)]

possible combination using all alphabets sets would be

All possible combinations : ['yni', 'yno', 'ynu', 'ybi', 'ybo', 'ybu', 'uni', 'uno', 'unu', 'ubi', 'ubo', 'ubu', 'ini', 'ino', 'inu', 'ibi', 'ibo', 'ibu']

Validated combinations : ['yni', 'yno', 'ynu', 'ybi', 'ybo', 'ybu', 'uni', 'uno', 'unu', 'ubi', 'ubo', 'ubu', 'ini', 'ino', 'inu', 'ibi', 'ibo', 'ibu']

Possible words : ['union', 'universal', 'united', ... 'inure', 'inurn', 'ibiblio']

Again system will wait for user to type something further,below output is for 4th keystroke.

3 800

3 805

END

Finger number 3 represents Left hand Index finger and average of all bending measurements would be 802.5. This average will be searched in Matrix L and we will get layer value “L” - Lower Layer. Now, Finger value(LI - Left hand Index) and Layer value(“L”) will fetch further set of alphabets from Matrix F.

Probability set : [('c', 12.0), ('v', 9.0)]

Using past sets, system will make possible combination of alphabets and again it will filter with valid combination process.

All possible combinations : ['ynic', 'yniv', 'ynoc', 'ynov', 'ynuc', 'ynuv', 'ybic', 'ybiv', 'yboc', 'ybov', 'ybuc', 'ybuv', 'unic', 'univ', 'unoc', 'unov', 'unuc', 'unuv', 'ubic', 'ubiv', 'uboc', 'ubov', 'ubuc', 'ubuv', 'inic', 'iniv', 'inoc', 'inov', 'inuc', 'inuv', 'ibic', 'ibiv', 'iboc', 'ibov', 'ibuc', 'ibuv']

Validated combinations : ['ynic', 'yniv', 'ynoc', 'ynov', 'ynuc', 'ynuv', 'ybic', 'ybiv', 'yboc', 'ybov', 'ybuc', 'ybuv', 'unic', 'univ', 'unoc', 'unov', 'unuc', 'unuv', 'ubic', 'ubiv', 'uboc', 'ubov', 'ubuc', 'ubuv', 'inic', 'iniv', 'inoc', 'inov', 'inuc', 'inuv', 'ibic', 'ibiv', 'iboc', 'ibov', 'ibuc', 'ibuv']  
Possible words from valid combinations are ['unicorns', 'unicorn', 'universal','universes', 'universe', 'university', 'universities', 'universally', 'univ', 'universale', 'inoculate']

Here, User can see the word “universe” which he or she intended to type. If the user long presses the left thumb, one by one words will be shown from the list of possible word combinations to the user to finalize the word. Example of the word selection process is as follows:

LTL //Allows user to switch between words from possible combinations.  
Current selected word : unicorns  
Keep long pressing left thumb to iterate over the list of possible words : ['unicorns', 'unicorn', 'universal', 'universe', 'university', 'universities', 'universally', 'univ', 'universale\_', 'inoculate']

LTL  
Current selected word : unicorn  
Keep long pressing left thumb to iterate over the list of possible words : ['unicorns', 'unicorn', 'universal', 'universe', 'university', 'universities', 'universally', 'univ', 'universale\_', 'inoculate']

LTL  
Current selected word : universal  
Keep long pressing left thumb to iterate over the list of possible words : ['unicorns', 'unicorn', 'universal', 'universe', 'university', 'universities', 'universally', 'univ', 'universale\_', 'inoculate']

LTL  
Current selected word : universes  
Keep long pressing left thumb to iterate over the list of possible words : ['unicorns', 'unicorn', 'universal', 'universe', 'university', 'universities', 'universally', 'univ', 'universale\_', 'inoculate']

LTL //Desired word is picked up  
Current selected word : universe  
Keep long pressing left thumb to iterate over the list of possible words : ['unicorns', 'unicorn', 'universal', 'universe', 'university', 'universities', 'universally', 'univ', 'universale\_', 'inoculate']

LTL END //Release left thumb long pressing action.   
  
selected word : universe // Selected word  
Start typing ahead

If the user don’t want to confirm the word by long tapping left thumb and he wants his desired word first in the list, he can continue typing.

Below are inputs to the system for user’s 5th keystroke.

2 544

2 538

2 536

END

Here finger value 2 represents Left hand Middle(LM) finger. Average value of all bending measurements is 539.33. This value will be searched in Matrix L’s columns which represents LM minimum maximum ranges. We will get output “U” - Upper layer for this.

Now finger value(LM) and layer value(U) will be further fed to Matrix F to fetch set of alphabets.

Probability set : [('e', 26.0)]

Using past sets, system will make possible combination of alphabets and again it will filter with valid combination process.

All possible combinations : ['ynice', 'ynive', 'ynoce', 'ynove'... 'ibove', 'ibuce', 'ibuve']

Validated combinations : ['ynice', 'ynive', 'ynoce', 'ynove'... 'ibove', 'ibuce', 'ibuve']

Possible words from valid combinations are ['universal','universes', 'universe', 'university', 'universities', 'universally']

System will read inputs for user’s 6th key stroke.

3 548

3 539

END

Here finger value 3 represents Left hand Index(LI) finger and average of bending measurements would be 543.5. This value will be searched in Matrix L and we will get Layer value (“U”).

Now Value of layer (U) and finger(LI) will further fetch set of alphabets.

Probability set : [('r', 22.0),('t', 21.0)]

Using past sets, system will make possible combination of alphabets and again it will filter with valid combination process.

All possible combinations : ['ynicer', 'yniver', 'ynocer', 'ynover'... 'ibovet', 'ibucet', 'ibuvet']

Validated combinations : ['ynicer', 'yniver', 'ynocer', 'ynover'... 'ibovet', 'ibucet', 'ibuvet']

Possible words from valid combinations are ['universal','universes', 'universe', 'university', 'universities', 'universally']

Now user will tap his finger for 7th time to press s. Below reading we will get for given input :

1 829

END

Here finger value 1 represents Left hand Ring(LR) finger. Here we got only one value so we don’t average this value. This value further will be searched in Matrix L to get layer information. This value will give us middle layer(M) from Matrix L.

Finger value(LR) and layer value(M) fed to Matrix F and we will get below set of alphabets.

Probability set : [('s', 11.0)]

Using past sets, system will make possible combination of alphabets and again it will filter with valid combination process.

All possible combinations : ['ynicers', 'ynivers', 'ynocers', 'ynovers'... 'ibovets', 'ibucets', 'ibuvets']

Validated combinations : ['ynicers', 'ynivers', 'ynocers', 'ynovers'... 'ibovets', 'ibucets', 'ibuvets']

Possible words from valid combinations are ['universal','universes', 'universe', 'university', 'universities', 'universally']

Further user will type his 8th keystroke and results are shown below.

2 540

2 539

2 531

END

Here finger value 2 represents Left hand Middle(LM) finger. Average value of all bending measurements is 536.66. This value will be searched in Matrix L’s columns which represents LM minimum maximum ranges. We will get output “U” - Upper layer for this.

Now finger value(LM) and layer value(U) will be further fed to Matrix F to fetch set of alphabets.

Probability set : [('e', 26.0)]

Using past sets, system will make possible combination of alphabets and again it will filter with valid combination process.

All possible combinations : ['ynicerse', 'yniverse', 'ynocerse', 'ynoverse'... 'ibovetse', 'ibucetse', 'ibuvetse']

Validated combinations : ['ynicerse', 'yniverse', 'ynocerse', 'ynoverse'... 'ibovetse', 'ibucetse', 'ibuvetse']

Possible words from valid combinations are ['universes', 'universe']

Now user has pressed 8 times which equal to length of word he wanted to type. So now to confirm the word length he presses left hand thumb once and it will confirm the word length to 8 and only shows words with length 8.

LTT  
Length of the words are : 8   
['universe']  
Long tap left thumb to select the word

LTL  
Current selected word : universe   
Keep long pressing left thumb to iterate over the list of possible words : ['universe']  
Leave the left thumb to select the word : universe   
  
LTL END //Release left thumb pressing  
  
 selected word : universe //Selected word  
Start typing ahead