Capstone Project 2: NLP Track - Youtube – Finding the most applicable content for a specific topic – Tom Preston

Study Background:

Millions of people use Youtube daily for learning how to do things. Diverse topics from how to replace a watch battery to how to learn Python is available however you often have to sift through lots of videos to find the "really good ones". I personally use Youtube (YT) daily for finding training materials on Python and Data Science. My challenge is that YT's search is helpful but the search options are based on "relevance" (proprietary algorithm determined by YT), view count, and ratings. I would like a better way to assess and prioritize the content I am looking for.

My goal for this Capstone is to use the YT API to read in the video title, summary description, comments and likes / dislikes to find relevant content more quickly. I will use NLP techniques to review the document titles, summaries and comments to rank these videos to determine their relevance to my search criteria. I tested this on a subject like python (a subject I personally spend a lot of time in YT looking at) to see if this approach improves upon my manual searches.

I defined a set of queries below that are meant to be broad topics around two different topic areas, python and golf. Below is the initial set of draft queries.

Python Queries	
Python tutorial	Python dictionaries
Python reading CSV files	Python sort functions
Python pandas DataFrames	Python for loops
Python lists	Python tuples

Data Source

YT provides an API to search videos and extract statistics. The API accepts different types of queries and provides a nested dictionary of the results. There are a few challenges when using the YT API. First, you have to go to developers.google.com and register your email address to get an API key. This API key has to be part of the data query to YT. Second, the YT API query and related error messages are not very intuitive on how to use or troubleshoot. This YT method creates a googleapiclient.discovery.Resource type when must be instantiated before running queries.

Data Wrangling:

Data Setup and Cleaning

The three main YT queries are video searches (using a search phrase), statistics query, and the comments query.

Video Searches: A call to the YT API with a search query returns a standard python dictionary of search requests. The query returns up to 50 videos based on relevance to the query. The "relevance" is a proprietary YT algorithm. The "query_results" response has a nested dictionary for each video (see below). Key items (shown below) are the video Id, title, and description. Also, this query has over 1,000,000 results and YT only allows you to request 50 results per query. A function using the nextPageToken allow a user to request a series of continuous results. An extract of the query result is shown below.

Query_results – first nested dictionary entry (key items bolded):

{'kind': 'youtube#searchListResponse',
 'etag': '"p4VTdlkQv3HQeTEaXgvLePAydmU/XzqcriHV8BFFo0Vqw6zP2YmSLYc"',
 'nextPageToken': 'CDIQAA',
 'regionCode': 'US',
 'pageInfo': {'totalResults': 1000000, 'resultsPerPage': 50},
 'items': [{'kind': 'youtube#searchResult',
   'etag': '"p4VTdlkQv3HQeTEaXgvLePAydmU/z11WbGTNgEvyDRL_DFX3UN5ZeyQ"',
   'id': {'kind': 'youtube#video', **'videoId': 'rfscVS0vtbw'},**
   'snippet': {'publishedAt': '2018-07-11T18:00:42.000Z',
    'channelId': 'UC8butISFwT-Wl7EV0hUK0BQ',
    'title': 'Learn Python - Full Course for Beginners [Tutorial]',
    'description': "This course will give you a full introduction into all of the core concepts in
python. Follow along with the videos and you'll be a python programmer in no time!",
    'thumbnails': {'default': {'url': 'https://i.ytimg.com/vi/rfscVS0vtbw/default.jpg',
     'width': 120,
     'height': 90},
    'medium': {'url': 'https://i.ytimg.com/vi/rfscVS0vtbw/mqdefault.jpg',
     'width': 320,
     'height': 180},
    'high': {'url': 'https://i.ytimg.com/vi/rfscVS0vtbw/hqdefault.jpg',
     'width': 480,
     'height': 360}},
   'channelTitle': 'freeCodeCamp.org',
   'liveBroadcastContent': 'none'}},

Video Requests Data Wrangling. I initially queried the top 50 results for each search query. After reviewing the results, analyzing the first 25 queries is reasonable. As shown in appendix A, for all eight python queries, the first 5 – 10 typically have significantly more views. In my analysis, the queries 25 – 50 often do not have enough views or comments to provide much insights. The results 11 – 25 typically do have enough information (views, comments, etc) to be useful in the analysis.

The age of each video is calculated in weeks using the datetime module. It's assumed that newer videos will probably not be the most viewed however their ratio of likes to views might

identify promising new videos which are exactly the ones I am trying to find by adjusting the search criteria. The video request information is exacted into a list and then converted into a pandas DataFrame to be merged with the statistics information.

Video Statistics: The second query is the video statistics query where a video id (each YT video has a unique alpha-numeric video id) is required to retrieve the video statistics (view count, like count, dislike count and comment count). The video IDs are exacted from the initial video search query results and then combined into a single string. The YT statistics query allows a user to query video statistics either via single or group requests. To be a "good" user, I ask for the video statistics in one group request instead of 25 individual requests for each of the 8 python queries.

Video Statistics Result (key items bolded):

{'kind': 'youtube#videoListResponse',
 'etag': '"p4VTdlkQv3HQeTEaXgvLePAydmU/qiy6k0yl5Y3g3e2QvCZEX05VHlk"',
 'pageInfo': {'totalResults': 50, 'resultsPerPage': 50},
 'items': [{'kind': 'youtube#video',
   'etag': '"p4VTdlkQv3HQeTEaXgvLePAydmU/0UAojIcSxzPMfuQXkS_PxoeHKmc"',
   'id': 'q5uM4VKywbA',
   'statistics': {'viewCount': '327156',
    'likeCount': '4973',
    'dislikeCount': '51',
    'favoriteCount': '0',
    'commentCount': '364'}},
  {'kind': 'youtube#video',
   'etag': '"p4VTdlkQv3HQeTEaXgvLePAydmU/0--4nW9re9Qy8_Cjvdu-hVyrET8"',
   'id': 'Xi52tx6phRU',
   'statistics': {'viewCount': '259361',
    'likeCount': '4764',
    'dislikeCount': '126',
    'favoriteCount': '0',
    'commentCount': '301'}},

Video Statistics Data Wrangling: As shown above, the YT video statistics query returns a nested dictionary entry for each video. The information is exacted into a list and then converted into a pandas DataFrame. This information is then merged with the video statistics to create one DataFrame per query.

The query below (Python query 1 – "python tutorial") is broad query. As shown by the 9M views for the first result, it's by far the most viewed. After the top 5, the view count drops off steadily. Interestingly, as a user scroll down the results list, YT will keep showing the video results but after about 30 – 40 results, the results are not as relevant to the search criteria.

Python query 1 – "python tutorial" Top 25 results:

Query Num	Query	Search Rank	Channel	Video ID	Video Title	Video Description	Video Age	view count	like count	dislike count	comment count
P1	python tutorial	1	freeCodeCamp.org	rfscVS0vtbw	Learn Python - Full	This course will giv	64	9008855	211081	2703	11961
P1	python tutorial	2	Programming with Mosh	_uQrJ0TkZlc	Python Tutorial for	Python tutorial fo	32	4810630	177478	1251	11936
P1	python tutorial	3	CS Dojo	Z1Yd7upQsXY	Python Tutorial for	Learn Python prog	92	3587298	70809	1130	4649
P1	python tutorial	4	Programming with Mosh	f79MRyMsjrQ	Python Tutorial for	Finally a Python tu	49	359370	6532	184	601
P1	python tutorial	5	CS Dojo	kLZuut1fYzQ	What Can You Do w	What is Python us	67	1535629	44954	681	1505
P1	python tutorial	6	Derek Banas	H1elmMBnykA	Python Tutorial 201	Get my Ultimate P	6	39582	1415	14	391
P1	python tutorial	7	edureka!	vaysJAMDaZw	Python Tutorial For	Edureka Python Tr	30	521642	9283	175	302
P1	python tutorial	8	Derek Banas	N4mEzFDjqtA	Python Programmin	Get my Ultimate P	255	5158257	69531	1661	6481
P1	python tutorial	9	TechLead	5mJ_Qftw2_0	How to Learn Pytho	Ex-Google Tech Le	58	281454	12430	324	908
P1	python tutorial	10	Corey Schafer	ZDa-Z5JzLYM	Python OOP Tutoria	In this Python Obje	171	1432106	36996	242	1891
P1	python tutorial	11	freeCodeCamp.org	8DvywoWv6fI	Python for Everybo	This Python 3 tuto	22	604481	22924	192	864
P1	python tutorial	12	Socratica	apACNr7DC_s	Python Classes and	Classes are a funda	120	435342	11972	282	639
P1	python tutorial	13	freeCodeCamp.org	C6jJg9Zan7w	Python Game Tutor	A Pong clone gam	41	109128	2163	33	492
P1	python tutorial	14	ProgrammingKnowledge	bZ6NL59FMoc	Full Python Progra	Python is one of to	23	184368	2799	61	106
P1	python tutorial	15	Corey Schafer	9Os0o3wzS_I	Python Tutorial for	In this Python Beg	124	379673	6420	106	402
P1	python tutorial	16	Intellipaat	5GYeia8IRbg	Python Tutorial | Py	Intellipaat Python	19	136765	3897	84	250
P1	python tutorial	17	CS Dojo	NSbOtYzIQI0	How To Use Functio	This entire series i	90	760748	10462	163	1381
P1	python tutorial	18	Intellipaat	pJ3IPRqiD2M	Python Tutorial for	Intellipaat Python	7	293894	11636	239	469
P1	python tutorial	19	Corey Schafer	W8KRzm-HUcc	Python Tutorial for	In this Python Beg	124	352165	8524	46	487
P1	python tutorial	20	Multimedia Channel	3cZsjOclmoM	Zero to Hero with P	Are you brand nev	101	168003	1946	83	129
P1	python tutorial	21	Academind	kDdTgxv2Vv0	Python Tutorial for	Learn Python from	30	87192	2228	41	193
P1	python tutorial	22	freeCodeCamp.org	CD4qAhfFuLo	Snake Game Python	Learn to code a sn	48	155749	1801	66	188
P1	python tutorial	23	kjdElectronics	cpPG0bKHYKc	Python Beginner Tu	This Python Progra	298	2741687	11750	765	1191
P1	python tutorial	24	Durga Software Solutions	v_S64kldryc	Learn Python - Full F	This course will pr	29	510953	12052	388	799
P1	python tutorial	25	kjdElectronics	uPwztoPBVWI	Python Beginner Tu	This tutorial cover	123	73602	711	7	92

The next query below (Python query 8 – "python tuples") is a more specific python related query. The first result only have 167K views and after the seventh query, the number of view drops off steady. These are the type of focused queries where other ways to rank the video could move it up on the results list.

Python query 8 – "python tuples" Top 25 results:

Query Num	Query	Search Rank	Channel	Video ID	Video Title	Video Description	Video Age	view count	like count	dislike count	comment count
P8	python tuples	1	Socratica	NI26dqhs2Rk	Python Tuples || Python Tutorial	Python Tuples are s	166	167433	3619	69	203
P8	python tuples	2	Corey Schafer	W8KRzm-HUcc	Python Tutorial for Beginners 4: List	In this Python Begin	124	352186	8525	46	487
P8	python tuples	3	Telusko	Mf7eFtbVxFM	#6 Python Tutorial for Beginners | T	Python Tutorial to le	65	330634	5398	59	474
P8	python tuples	4	sentdex	RVXIBZvg-W8	Python 3 Programming Tutorial - Lis	In this programming	273	130938	1171	22	77
P8	python tuples	5	Sundeep Saradhi Kanthety	bdS4dHIJGBc	PYTHON TUPLES (Creating , Updatin	1) Creating a Tuple	53	5775	162	1	15
P8	python tuples	6	Joe James	R-HLU9Fl5ug	Python: Data Structures - Lists, Tupl	Tutorial on data stru	227	174020	3830	60	179
P8	python tuples	7	Kindson The Tech Pro	n0krwG38SHI	Difference Between List, Tuple, Set a	This Tutorials explai	40	6465	100	7	14
P8	python tuples	8	MIT OpenCourseWare	RvRKT-jXvko	5. Tuples, Lists, Aliasing, Mutability,	MIT 6.0001 Introdu	137	70384	540	21	62
P8	python tuples	9	Simplilearn	wRC4H-k57eg	Python Tuples | Python Tuples Tuto	This Python tuples t	36	3057	70	2	17
P8	python tuples	10	MIT OpenCourseWare	ncpb4wIsQu8	Tuples	MIT 6.0001 Introdu	137	16581	80	13	12
P8	python tuples	11	Mike Dane	DehzAA0ZlhA	Tuples | Python | Tutorial 13	Giraffe Academy is	102	4864	147	0	5
P8	python tuples	12	TheCodex	2Df-unA0xNA	Python Programming #7 - Tuples	Python Programmin	121	7150	89	0	11
P8	python tuples	13	edureka!	QswQA1lRIQY	Python Collections: Lists, Tuples, Set	Python Certification	15	6138	190	4	7
P8	python tuples	14	Chuck Severance	odIMpHInDbA	Python for Informatics - Chapter 10	This is Chapter 10 fr	349	29368	212	3	28
P8	python tuples	15	edureka!	fAw8pM_dQP4	Python Lists | Python Tuples | Pyth	Python Training : ht	130	46729	403	7	38
P8	python tuples	16	Keith Galli	_zFI6ytHHdY	Lists & Tuples in Python - Begin	In this video, we go	82	3036	130	1	46
P8	python tuples	17	GeeksforGeeks	lv_Z6loukOs	Python Programming Tutorial - Tupl	Find Complete Code	114	4054	26	0	3
P8	python tuples	18	Clever Programmer	gGTDBKsYfRc	Learn Python Programming - 34 - Tu	Enroll for exercises,	145	15430	154	6	21
P8	python tuples	19	ProgrammingKnowledge	XQOWZidQSnE	Python Tutorial for Beginners 14 - P	In this video I am go	56	10862	107	1	15
P8	python tuples	20	Durga Software Solutions	r3pRMDerAJw	Fundamental Data Types || Python	Python Tutorial ||a	29	1369	35	0	7
P8	python tuples	21	LearnVern	3ApyXxihs-A	Tuples in Python - Part 1 | Video In I	For more Free cour	67	1894	41	2	6
P8	python tuples	22	Sundeep Saradhi Kanthety	TItKabcTTQ4	BASIC OPERATIONS ON TUPLES - PY	1) LENGTH 2) CONC	53	2708	84	1	14
P8	python tuples	23	Corey Schafer	GfxJYp9_nJA	Python Tutorial: Namedtuple - Whe	Named Tuples in Py	221	40429	966	4	42
P8	python tuples	24	SimplyCoded	YTa0wbrOeEo	12 - Tuples (unpacking) | Python Tu	The read-only list. L	129	1768	31	0	5
P8	python tuples	25	Amuls Academy	kxBXrdbGSvo	Python Tuples | Python Programmi	In this Python Progr	157	9921	77	0	13

Extracting the dictionary data into dataframes took some effort to optimize the code and the queries. One interesting challenge is the fact the video owners can turn off comments on their videos. When this happens, there are no statistics for likes, dislikes, or comments. YT just skips that information in the dictionary response, and I had to check for that condition and put zeros in the impacted fields.

Video Comments: The third query is the video comments query. This exacts the first 100 comments (selecting by relevance) for each video, populates lists to hold the comments, and then creates a dataframe. The dataframe is exported to excel.

Video Comments Search Query Results (key items bolded:

{'kind': 'youtube#commentThread',
  'etag': '"p4VTdlkQv3HQeTEaXgvLePAydmU/vWpuLBC_C_QJf9bmvK4Vq9nNUJo"',
  'id': 'UgzDzCdMIO235N77cK54AaABAg',
  'snippet': {'videoId': 'N0lxfilGfak',
   'topLevelComment': {'kind': 'youtube#comment',
    'etag': '"p4VTdlkQv3HQeTEaXgvLePAydmU/12KavxCw51GxXPaWHn7IEtIrfkk"',
    'id': 'UgzDzCdMIO235N77cK54AaABAg',
    'snippet': {'authorDisplayName': 'Triple Jay',
     'authorProfileImageUrl': 'https://yt3.ggpht.com/-CpH8J3FO_1Y/AAAAAAAAAAI/AAAAAAAAAAA/t7ljbaa_tZc/s28-c-k-no-mo-rj-c0xffffff/photo.jpg',
     'authorChannelUrl': 'http://www.youtube.com/channel/UC5Smaf9QTcCYaUfR9pxf98Q',
     'authorChannelId': {'value': 'UC5Smaf9QTcCYaUfR9pxf98Q'},
     'videoId': 'N0lxfilGfak',
     'textDisplay': "I'm new to python, but with this tutorial, i have by-passed my fears.. Thank you very much.",
     'textOriginal': "I'm new to python, but with this tutorial, i have by-passed my fears.. Thank you very much.",
     'canRate': True,
     'viewerRating': 'none',
     'likeCount': 1,
     'publishedAt': '2017-12-14T08:36:02.000Z',
     'updatedAt': '2017-12-14T08:36:02.000Z'}},
   'canReply': True,
   'totalReplyCount': 1,
   'isPublic': True}},

As shown in the query statistics above, each video can have as many as 11K comments (line 1 of the Python query 1) or as few as 3 comments (line 18 of the Python query 8). For this study, I am just extracting up to the first 100 'relevant' comments. If I took the most recent comments by date posted, that might provide a different view of the comments. However, given the relatively low numbers of dislikes across the video sample Isee video statistics on the next page), I observed most comments are either mostly positive or a question / comment (i.e. – "can you do a video on X topic…..", "can you explain your comment about Y at Z:ZZ in the video). Most people won't write too negative of a comment, especially for python coding topics.

Python query 1 – "python tutorial" Comments extract:

Query Num	Query	Channel	Video Num	Video ID	Video Title	eo Descript	Comment	omment Id	Replies	Likes
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	Hey everyone! Thanks for watching my courseFollow me on twitter at https://twitter.com	UgxKkKnul	276	4940
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	*[Comment Deleted]**You'll never how I got these likes*	UgzhpJCKH	38	2484
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	2400 dislikes are people that offer paid courses for programming.	Ugyz2bKLx	14	741
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	One minute in : Assigning a = 54 hours in : *Hacking the Pentagon*	Ugwayb-i_	3	302
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	print('friends')console: Error. You have no friends	UgyvKRt_N	4	222
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	0:00 introduction1:45 installing python and pycharm6:40 setup and hello world10:23 Dra	UgzulBKGn	199	7129
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	I retired this last year after having been a professional programmer for 39 years. Started	UgwYxzxJg	10	513
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	Funny that it counts characters in the string including the "" but it starts with G = 0 hmm	UgxuHnZzl	0	1
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	print("hello world")	UgwlEPc-_	2	3
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	/oo ? Agency =[AISA,NASA]For i in Agency:Print(i)	UgxCZjJpkv	0	0
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	Haha, i have a python exam tomorrow, im only 45 mins into this video and ive already lea	Ugw2wn1t	116	2333
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	This dude is brilliant at explaining things for a beginner, I've learned more from this 4 hou	Ugwil_hLvy	13	170
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	Im 50 and dont know anything about programing , but this is what I need to learn to built	Ugxx7Y07Z	7	83
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	friends = ["no one", "me", "myself"]:CCC	UgysCVQyl	0	6
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	Don't mind me, just setting my timestamp: 8:30	Ugx6HymZ	0	1
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	How many people in JULY/AUGUST/SEPTEMBER 2019?	UgwA5S8V	65	1619
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	Colleges after this course"I declare BANKRUPTCY!!"	Ugz-o3z67	0	10
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	python: *clean and concise*java: UsEr uSeR = nEw UsER();	Ugy3kmBC	3	60
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	Thank you so much for creating this course, I'm teaching myself python as I'll be able to u	Ugx56n2cc	0	0
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	Instructions unclear ended up hacking nasa headquarters naw jk	Ugzo6BGfj	4	85
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	Who is learning Python in March 2019???	Ugwy1P4B	246	3138
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	This course is extremely well done and performed... showing to beginners that Python is	UgwT9Tub	3	50
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	elif not(male) and is_wearingmansize13nikes: print("Beat that")	UgzkYBdKl	0	1
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	4 hours set it to 2x speed only 2 hours. Understandable but very usefull	Ugy3VeDic	4	44
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	My god i love how fast fire this is. Took a course in college and it was educational, but we	UgzWii_fnl	0	19
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	4 and a half hours long, yet no ads, Greatest man in the world!	Ugya39TPE	11	2421
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	1:09:22all these names are from the Office 😄Nice to see a fan of the show	UgxyTA5A0	0	1
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	I've spent well over an hour going through the first part of the tutorial and I have to say t	Ugwq3wQ;	0	0
P1	python tutorial	freeCodeC	1	rfscVS0vtbw	Learn Python - Full Cou	This course	/oo? 4h is too long split this in episodes.. youtube recommend 10mn	UgzIuMBp;	0	0

The comments extract above highlights the challenges with reviewing the comments. A majority will be generally positive and the others typically fall into 2 categories (a question or a comment). The key is to focus on the positive comments (ie. – "great video", "very clear instruction", etc). It's easy for a YT viewer to just click the Like button but taking the time to type in a positive comment shows an extra level of praise for the video content.

Data EDA & Analysis:

Python Query Summary Video Statistics: The Python queries video statistics table below shows the total number of views (46.8M), likes (947K) and dislikes (14K) for the 8 python related queries. In aggregate, the videos only averaged getting 1.6% of likes compared to the total views. Since the total number of dislikes is also very small, the ratio of dislikes to likes is just 1.8% (meaning for 1,000 likes, on average there is only 18 dislikes for the top 25 videos).

The comments numbers are even smaller. Across the whole population, there was only 65K comments vs. 46.8M views (0.1%). If people are going to take the time to write a comment, they should have extra weighting in the search results. I extracted the top 100 "relevant" comments from each of the top 25 videos from the eight python queries for a total of 8,492 (13%) comments across 200 videos (65K total comments). For the top viewed videos, it's a pretty small subset of the comments but for the top 10 – 25 videos for each query, often, they had less than 100 total comments for the less viewed videos.

Python Query Summary Video Statistics:

Python Query	Total Views for top 25 results	Total Likes for top 25 results	Total Dislikes for top 25 results	Total Comments	Total Extracted Comments	Hand Tagged Comments
1) Python tutorial	33,728,573	751,794 (2.2%)	10,921 (1.5%)	48,307	2,366 (5%)	595

2) Python reading CSV files	2,231,893	27,462 (1.2%)	616 (2.2%)	2,263	808 (36%)	264
3) Python pandas DataFrames	1,214,931	18,761 (1.5%)	378 (2.0%)	1,912	721 (38%)	111
4) Python lists	2,956,419	50,627 (1.7%)	616 (1.2%)	3,869	1,282 (33%)	50
5) Python dictionaries	1,650,572	28,577 (1.7%)	472 (1.7%)	2,170	1,016 (47%)	25
6) Python sort functions	419,081	7,567 (1.8%)	185 (2.4%)	678	432 (64%)	25
7) Python for loops	3,195,745	36,107 (1.1%)	836 (2.3%)	4,358	1,184 (27%)	25
8) Python tuples	1,443,193	26,187 (1.8%)	329 (1.3%)	1,801	683 (38%)	25
Totals:	**46,840,407**	**947,082 (1.6%)**	**14,353 (1.8%)**	**65,358 (0.1%)**	**8,492 (13%)**	**1,120 (13%)**

I hand tagged 1,120 comments (1 = positive, 0 = other) to develop a train-test data set to classify the other videos comments. I will classify the remaining 7,372 comments to see if these classifications will help determine if the percentage of positive comments might be used to alter the YT video search rankings.

Python Query Analysis: The video statistics data from each of the 8 separate python queries is graphed in Appendix A. The following metrics were gathered for each of the top 25 videos: age (calculated in weeks), total views, total likes (i.e. – a user clicks on the thumbs up icon), total dislikes (i.e. – a user clicks on the thumbs down icon), and total comments (a user posts a comment and his YT user id is also posted).

The chart for Python Query 2 – "python reading CSV files" is indicative of the 8 charts in Appendix A. The key observations are:

Age: The top 5- 10 videos are typically 1 – 2 years old. The top 11 – 25 videos age can vary widely (brand new to several years old.

Like Count: As shown in the video statistics summary table above, each video receives on average 1.6% likes per view ratio (for 1,000 views, it will get 16 likes). The 5-8 videos get the most likes and it then steadily drops from there. When a user search YT, the first few videos show up in the search results. Once a user selects 1 video, another 5 – 6 show up in a sidebar view. Most users probably just view the videos where they see the video listed on the main landing page and they do not seem to search manually through the results list.

The significance of this result is that unless a video makes the top 5 – 8 results, it will be difficult for it to make it to the top of the search results.

Dislike Count: While the total like count is approximately 1.6% of the total view count, the total dislike count is only 1.8% of the like count. This number is so small, it's off limited value.

Comments Count: Users comment on only 0.1% of all views (1 comment per 1,000 views). After personally reviewing and tagging 1,120 python query comments, there is a definitely pattern to the comments. A majority (estimate 75%) are positive comments and another 20% are questions / comments. Certain videos that provide unclear python coding demonstrations which might be confusing or have errors generate a large number of questions in the comments section.

The key here is seeing which comments have a vast majority of positive comments. Certain videos channels (Corey Schafer, Socratica, etc.) get very positive reviews for their valuable content.

Overall, the charting of these metrics across the 4 key data points (views, likes, dislikes, comments) all follow a similar pattern – the views set the pattern and the likes, dislikes, and comments data is in proportion to the views.

The Python Query 2 (reading CSV files) does show an interesting data spike in video 23. The video is listed in the 23 query result yet it has the highest views (200K more than the number 1 video) as well as more likes, more comments and less dislikes. Upon reviewing the data, the video in question is from the python exper Corey Schafer. I have personally viewed many of his videos and they are always excellent.

The highlights a key issue around video title and video description relevance in the YT search query. Interestingly Corey Schafer is the author of the number 1 ranked video for reading CSV files. His video title and video description both mention "reading CSV files". His 23rd ranked video is called "reading files in python". It does not mention CSV files in either the video title or description. This shows that the video title and description relevance is key to video ranking even when a similar video has literally 200K more views.

Python Query 2: "Python reading CSV files"

P2 python reading CSV files
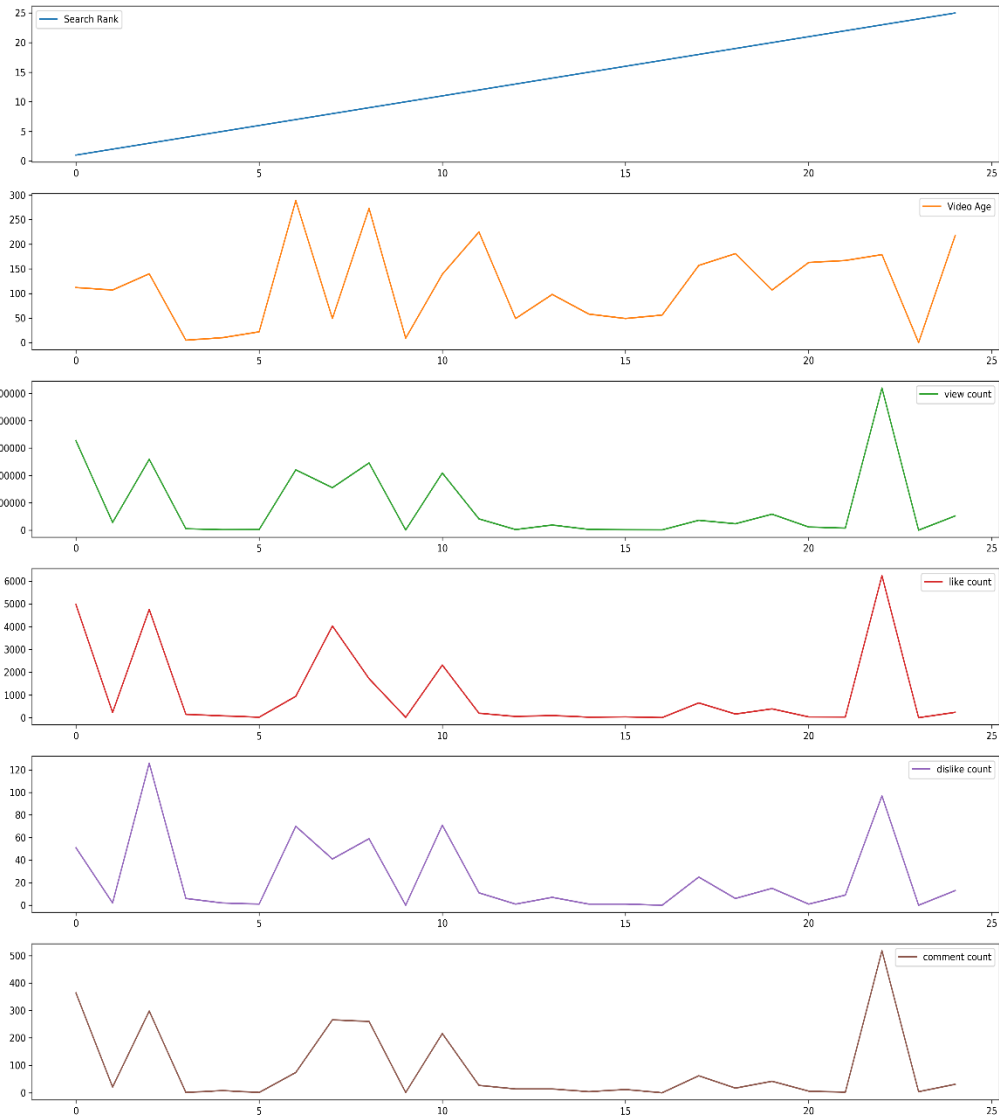
Machine Learning Application

As highlighted above, YT provides video search results based off a proprietary algorithm using multiple features (video title, video description, analysis of the video transcript, view counts, like counts, dislike counts, and user viewing history). While some of the view statistics are available to user analysis, many other items (video transcripts, user viewing history) are not available via the YT api. In addition, the YT api only exports the first 175 characters of the video description.

Naïve Bayes: YT does export the entire length of each video comment. I will apply Naïve Bayes to classify the comments as either '1' (a positive comment about the video) or '0' (either a question, basic statement, or unrelated statement). The YT summary statistics table above shows that comments are a small percentage of the total views however I will be using the positive comment count as a way to reorder the top 25 video results for each of the 8 python queries in an effort to more quickly find relevant content.

I hand tagged 1,120 comments out of the 8,492 extracted comments. While I initially thought the comments would be predominantly positive, my manual assessment found 635 (57%) positive and 485 (43%) other comments.

Manually Flagged Comments Distribution

Comment Type	# / %	Observations
Positive	635 (57%)	Very similar types of comments – "great job, great video, I learned a lot", etc – generally very concise and very positive.
Other	485 (43%)	Broad range of comments often more editorial than praising the video. Also, if a video is showing how to code something in python and it's confusing, there will be many questions in the video comments.

I trained and tested the 1,120 classified comments using sklearn Naïve Bayes. The 75/25 train test split trained on 840 comments and tested on 280 comments. **The overall accuracy score is 78%**. The confusion matrix is below.

Naïve Bayes Confusion matrix – 280 obs.		
121 Other Comments	62 (true positive	59 (false positive)
159 Positive Comments	2 (false negative)	157 (true negative)

An analysis of the false positives showed that when people included a positive comment and a question, Naïve Bayes would mislabel them. Also, people would request other videos (i.e. – please do a video on python lambda functions) and these would also be false positives. The two false negatives also had a mix of positive comments and questions.

The document term matrix was analyzed to determine the top 20 tokens for positive comments. A "positive ratio" (# of times a token was in a "positive" statement / # of times the token was in an 'other" statement) was calculated for each token. The table below is indicative of the positive tokens we would expect for positive feedback on a video (i.e. – thank you very much, great video, awesome video, you are a great teacher, etc.).

Top 20 Positive Comment Tokens

Token	Positive Count	Other Count	Ratio
thank	157.0	11.0	14.272727
much	78.0	6.0	13.000000
awesome	36.0	3.0	12.000000
excellent	23.0	2.0	11.500000
very	80.0	7.0	11.428571
best	55.0	5.0	11.000000
amazing	30.0	3.0	10.000000
great	78.0	8.0	9.750000
videos	60.0	7.0	8.571429
watched	17.0	2.0	8.500000
simple	15.0	2.0	7.500000
teacher	22.0	3.0	7.333333
far	14.0	2.0	7.000000
useful	13.0	2.0	6.500000
clear	19.0	3.0	6.333333
helped	12.0	2.0	6.000000
really	41.0	7.0	5.857143
2017	11.0	2.0	5.500000
thanks	117.0	23.0	5.086957
wonderful	10.0	2.0	5.000000

Improving Prediction Accuracy: The Naïve Bayes model was 78% accurate. There are several options in the sklearn Naïve Bayes Count Vectorizer to adjust to improve overall model accuracy.

CountVectorizer comes with several default parameters as shown below.

```
CountVectorizer(analyzer='word', binary=False, decode_error='strict',
    dtype=<class 'numpy.int64'>, encoding='utf-8', input='content',
    lowercase=True, max_df=1.0, max_features=None, min_df=1,
    ngram_range=(1, 1), preprocessor=None, stop_words=None,
    strip_accents=None, token_pattern='(?u)\\b\\w\\w+\\b',
    tokenizer=None, vocabulary=None)
```

The table below shows the additional parameter setting tested to improve prediction accuracy. These items were tested 1 at a time (ie – just one adjustment to the default parameters for each test)

CountVectorizer Parameter Testing

Parameter	Description	Prediction Impact
Default	Default Settings	78.2% (baseline)
Lowercase = false	Do not make all tokens lowercase	74.2% (-4%)
Ngram_range = (1,2)	Use 1 and 2 work ngrams	77.8% (-0.4%)
Max_df = 0,5	Ignore terms that appear in 50% 2.8% of the documents	78.2% (no change)
Min_df = 2	Term must appear in at least 2 documents	81.0% (2.8% increase)
Combining 2 settings: Ngram_range = (1,2) Min_df = 3	Use 1 and 2 work ngrams Term must appear in at least 2 documents	82.8% (4.6% increase)

By using Ngram_range = (1,2) and Min_df = 3, the accuracy was increased from 78.2% to 82.8% (4.6% increase). This is the final settings to use for predicting the type of the remaining untagged 7,372 comments)

Comment Prediction:

Using the Naïve Bayes CountVectorizer settings above, the remaining untagged 7,372 comments were processed and their comment type was predicted. The Naïve Bayes provides a prediction percentage from 0.0 to 1.0. The table below summarized the probability distribution.

Bayes Probability	Comment Count	Comment Disposition
(0.9, 1.0]	3851	Positive
(0.8, 0.9]	305	Positive
(0.7, 0.8]	166	Other
(0.6, 0.7]	129	Other
(0.5, 0.6]	293	Other
(0.4, 0.5]	126	Other
(0.3, 0.4]	136	Other
(0.2, 0.3]	188	Other
(0.1, 0.2]	252	Other
(0.0, 0.1]	1926	Other
	7,372 (Total Comments)	

I used a Bayes probability of .80 or higher to flag a comment as either Positive or Other. The Bayes prediction comment distribution is very similar to the manually flagged distribution.

Comment Type	Manually Flagged	Bayes Prediction (>= .80 = Positive Comment)	Totals
Positive	635 (57%)	4156 (56%)	4,791
Other	485 (43%)	3216 (44%)	3,701
Total:	1,120	7,372	8,492

With the 8,492 comments all being tagged or predicted as Positive or Other type comments, this information is merged with the YT summary statistics (each comment is tied to a video id) to be used in the video ranking analysis.

Positive Comments Sorted by Highest Number

Query N	Query_x	Search Rank	Channel	Video ID	Video_Title	Video Age	view count	like coun	dislike cou	comment count	Very_Pos
P1	python tutorial	19	Corey Schafer	W8KRzm-HUc	Python Tutorial for Beginners 4: Lists, Tuples, and Se	124	352165	8524	46	487	256
P4	python lists	2	Corey Schafer	W8KRzm-HUc	Python Tutorial for Beginners 4: Lists, Tuples, and Se	124	352184	8525	46	487	256
P8	python tuples	2	Corey Schafer	W8KRzm-HUc	Python Tutorial for Beginners 4: Lists, Tuples, and Se	124	352186	8525	46	487	256
P4	python lists	10	Joe James	R-HLU9Fl5ug	Python: Data Structures - Lists, Tuples, Sets & D	227	174020	3830	60	179	228
P5	python dictionari	14	Joe James	R-HLU9Fl5ug	Python: Data Structures - Lists, Tuples, Sets & D	227	174020	3830	60	179	228
P8	python tuples	6	Joe James	R-HLU9Fl5ug	Python: Data Structures - Lists, Tuples, Sets & D	227	174020	3830	60	179	228
P4	python lists	16	Socratica	AhSvKGTh28Q	List Comprehension || Python Tutorial || Learn Py	126	156160	5055	50	249	156
P7	python for Loops	19	Socratica	AhSvKGTh28Q	List Comprehension || Python Tutorial || Learn Py	126	156160	5055	50	249	156
P4	python lists	18	Corey Schafer	3dt4OGnU5sN	Python Tutorial: Comprehensions - How they work a	214	182583	3960	30	288	154
P5	python dictionari	12	Corey Schafer	3dt4OGnU5sN	Python Tutorial: Comprehensions - How they work a	214	182583	3960	30	288	154
P2	python reading C	8	Keith Galli	vmEHClofslg	Complete Python Pandas Data Science Tutorial! (Rea	49	155424	4032	41	266	153
P3	python pandas da	4	Keith Galli	vmEHClofslg	Complete Python Pandas Data Science Tutorial! (Rea	49	155424	4032	41	266	153
P4	python lists	11	Corey Schafer	6iF8Xb7Z3wQ	Python Tutorial for Beginners 7: Loops and Iterations	124	199765	4460	47	186	118
P7	python for Loops	3	Corey Schafer	6iF8Xb7Z3wQ	Python Tutorial for Beginners 7: Loops and Iterations	124	199766	4460	47	186	118
P1	python tutorial	10	Corey Schafer	ZDa-Z5JzLYM	Python OOP Tutorial 1: Classes and Instances	171	1432106	36996	242	1891	92
P3	python pandas da	16	Data School	xvpNA7bC8cs	How do I select multiple rows and columns from a pa	173	116593	2487	21	452	88
P3	python pandas da	10	Data School	2AFGPdNn4FN	How do I filter rows of a pandas DataFrame by colun	179	120842	2068	27	482	82
P1	python tutorial	15	Corey Schafer	9Os0o3wzS_I	Python Tutorial for Beginners 8: Functions	124	379673	6420	106	402	77
P8	python tuples	1	Socratica	NI26dqhs2Rk	Python Tuples || Python Tutorial || Learn Python	166	167433	3619	69	203	77
P5	python dictionari	1	Corey Schafer	daefaLgNkw0	Python Tutorial for Beginners 5: Dictionaries - Worki	124	330708	7244	48	360	76
P1	python tutorial	5	CS Dojo	kLZuut1fYzQ	What Can You Do with Python? - The 3 Main Applica	67	1535629	44954	681	1505	73
P1	python tutorial	6	Derek Banas	H1elmMBnykA	Python Tutorial 2019	6	39582	1415	14	391	72
P2	python reading C	23	Corey Schafer	Uh2ebFW8OY	Python Tutorial: File Objects - Reading and Writing to	179	519861	6244	97	518	69
P2	python reading C	3	Socratica	Xi52tx6phRU	CSV Files in Python || Python Tutorial || Learn Pyt	140	259582	4758	126	298	68
P4	python lists	1	CS Dojo	tw7ror9x32s	Introduction To Lists In Python (Python Tutorial #4)	90	430234	6101	66	713	66
P1	python tutorial	24	Durga Software Solu	v_S64kldryc	Learn Python - Full Fundamental Course for Beginner	29	510953	12052	388	799	65
P1	python tutorial	3	CS Dojo	Z1Yd7upQsXY	Python for Absolute Beginners #1 - What Are	92	3587298	70809	1130	4649	64
P3	python pandas da	2	codebasics	F6kmIpWWEd	Python Pandas Tutorial 2: Dataframe Basics	140	231584	2993	65	206	64
P1	python tutorial	12	Socratica	apACNr7DC_s	Python Classes and Objects || Python Tutorial || L	120	435342	11972	282	639	63

The table above showed the videos with the most positive comments (Very_Pos column – far right of the table) show out of the 8,492 comments, the top 6 videos account for 1,065 of those comments. The videos also show up in multiple python queries (same video id for the different video queries). This highlights that video authors (Channels column above) such as Corey Schafer, Joe James. Socratica, and Keith Galli all seem to provide well liked python related content. I've seen videos from all of these authors and I personally think they all provide high caliber content.

After the top 6 Very_Pos comments counts, the remaining Very Pos comment counts evenly progresses from the 92 positive comments down to 0 positive comments in the remaining video summary statistics. I will use the non-normalized Very_Pos count in my final query reranking approach.

Fuzzy Matching: The second analysis item is determining if the video title and video description are close matches to the search term and if combining this information with the number of positive comments is a viable way to find more relevant videos in YT.

Fuzzywuzzy is a python method that uses the Levenshtein Distances to calculate the difference between text sequences. Fuzzywuzzy has 4 separate options in calculating text sequence differences.

Ratio Type / Query Notation	Description	Comment
Ratio (Title_R1, Descrip_R1)	Compares full query to full text	Needs exact query match for high ratio. Very sensitive to minor differences in word order and text length
Partial ratio (Title_R2, Descrip_R2)	Compares partial query to full text	Provides higher score for partial text matches.
Token_set ratio (Title_R3, Descrip_R3)	Breaks query and text into tokens and matches the sorted intersection	Provides most flexibility for sorted intersections of tokens.
Token_sort ratio (Title_R4, Descrip_R4)	Breaks query and text into tokens, sorts token and text and then calculates the match	More flexible but longer strings provide poor matching against shorter queries

The 4 ratios were calculated for each python query against both the video title and the video description. The table below is a subset of the 200 videos analyzed with Fuzzy Matching. After a review of the data, using the Title Set_Ratio (Title_R3 below) and the Description Set_Ratio (Descrip_R3 below) provided the best overall match scores for the videos. This is important for the less watched videos to get a higher matching score here in an effort to improve their query results ranking.

FuzzyMatching (python query vs video title and video description)

Query Num	Query	Search Rank	Video ID	Video_Title	Video Description	Title_R1	Title_R2	Title_R3	Title_R4	Descrip_R1	Descrip_R2	Descrip_R3	Descrip_R4
P1	python tutorial	1	rfscVS0vtb	Learn Python - Full Course f	This course will give you a full intro	39	60	100	48	10	67	57	11
P1	python tutorial	2	_uQrJ0TkZl	Python Tutorial for Beginne	Python tutorial for beginners - Lea	41	87	100	49	17	93	100	19
P1	python tutorial	3	Z1Yd7upQs	Python Tutorial for Absolut	Learn Python programming with tl	33	87	100	41	16	93	100	17
P1	python tutorial	4	f79MRyMs	Python Tutorial for Program	Finally a Python tutorial for progra	38	87	100	45	17	93	100	19
P1	python tutorial	5	kLZuut1fYz	What Can You Do with Pyth	What is Python used for? What ca	23	40	57	27	15	93	100	18
P1	python tutorial	6	H1elmMBr	Python Tutorial 2019	Get my Ultimate Python Tutorial S	74	87	100	86	16	87	100	20
P1	python tutorial	7	vaysJAMDa	Python Tutorial For Beginne	Edureka Python Training (Flat 20%	24	87	100	29	18	87	100	19
P1	python tutorial	8	N4mEzFDj	Python Programming	Get my Ultimate Python Tutorial S	55	60	61	36	15	87	100	18
P1	python tutorial	9	5mJ_Qftw2	How to Learn Python Tutori	Ex-Google Tech Lead teaches you	29	87	100	35	16	73	100	18
P1	python tutorial	10	ZDa-Z5JzLY	Python OOP Tutorial 1: Clas	In this Python Object-Oriented Tut	44	67	100	52	15	60	100	17
P1	python tutorial	11	8DvywoW\	Python for Everybody - Full	This Python 3 tutorial course aims	28	53	57	26	16	87	100	17
P1	python tutorial	12	apACNr7D	Python Classes and Objects	Classes are a fundamental part of	30	87	100	37	15	47	57	14
P1	python tutorial	13	C6jIg9Zan7	Python Game Tutorial: Pong	A Pong clone game tutorial for beg	63	60	100	75	14	60	100	21
P1	python tutorial	14	bZ6NL59FN	Full Python Programming C	Python is one of top 5 programmir	28	87	100	32	14	47	57	13
P1	python tutorial	15	9Os0o3wz!	Python Tutorial for Beginne	In this Python Beginner Tutorial, w	46	87	100	54	15	60	100	18
P1	python tutorial	16	5GYeia8IRl	Python Tutorial | Python Tu	Intellipaat Python course: https://	34	87	100	42	16	93	100	17
P1	python tutorial	17	NSbOtYzIQ	How To Use Functions In Py	This entire series in a playlist: https	42	87	100	48	14	40	15	13
P1	python tutorial	18	pJ3IPRqiD2	Python Tutorial for Beginne	Intellipaat Python for Data Science	45	87	100	54	18	93	100	19
P1	python tutorial	19	W8KRzm-+	Python Tutorial for Beginne	In this Python Beginner Tutorial, w	37	87	100	44	14	60	100	17
P1	python tutorial	20	3cZsjOclm	Zero to Hero with Python P	Are you brand new to coding? Wa	24	93	100	27	11	40	16	15
P1	python tutorial	21	kDdTgxv2V	Python Tutorial for Beginne	Learn Python from scratch by build	29	87	100	34	18	93	100	19
P1	python tutorial	22	CD4qAhfFu	Snake Game Python Tutoria	Learn to code a snake game using	63	87	100	73	14	47	57	15
P1	python tutorial	23	cpPG0bKH'	Python Beginner Tutorial 1	This Python Programming Tutorial	39	60	100	47	16	60	100	18
P1	python tutorial	24	v_S64kldry	Learn Python - Full Fundam	This course will provides you a full	26	87	100	30	14	53	57	12
P1	python tutorial	25	uPwztoPB\	Python Beginner Tutorial 3	This tutorial covers declaring funct	32	60	100	38	12	67	70	17
P2	python reading C	1	q5uM4VKy	Python Tutorial: CSV Modul	In this Python Programming Tutor	37	54	80	50	19	54	80	26
P2	python reading C	2	efSjcrp87O	Reading CSV Files In Python	Reading CSV files is a common tasl	59	62	100	94	18	67	100	29
P2	python reading C	3	Xi52tx6phF	CSV Files in Python ||	Working with CSV files is simple in	26	46	80	45	16	62	80	27
P2	python reading C	4	k5zkC7H9A	How to read CSV file in Pyth	Python Certification Training: http	31	67	59	44	21	54	59	28

As shown in the fuzzy matching table above, the Title Set Ratio (Title_R3) and the Description Set Ratio (Descrip_R3) generally have the best (highest) scoring ratio across the videos. I used these ratios as they give the videos lower in the Top 25 video results the best chance of scoring well with these ratios if their titles and descriptions contain the proper information related to the query. I reviewed these scores across all 200 video query results and the Title_R3 and Description_R3 provide the lesser watched videos the best chance of moving up in the video query rankings.

New Video Query Ranking Approach

As discussed above, YT has a proprietary algorithm to search videos. Often, the video with the highest view counts are near or are at the top of the search results. It's hard for the lower tier (say the videos in search position 10 – 25 of the top 25 results) to be viewed. I created a new scoring approach to find more relevant videos

Fuzzy Matching: By calculating the token sort ratio on the video title and video description, there are 2 results for each video (0-100 score) for both the video title and video description match.

Total Positive Comments: I used Naïve Bayes to classify 7,372 comments as Positive or Other comment types and I hand flagged another 1,120 comments. I am using each videos raw number of Positive comments as another indicator. Since a person must take the time to write and post a positive comment tied to their user name, I think the raw number of comments is important. Give the small percentage of comments, doing a normalization of positive comments to total views could yield different results however given that I only used 13% (8,492) of the 65K comments, the raw numbers of positive comments will be sufficient.

New Ranking Indicator Formula: The title and description fuzzy match ratios are averaged together and the positive comments is added to this to create a new score.

The first highlighted row from the Query 1 results shows Corey Schafer's python tutorial new score as the first video in the new ranking for Python Query 1 (first row in yellow below). The calculation for Corey Schafer's video is below:

Title_R3 Score	Descrip_R3 Score	Very_Pos Count	New Score
100	100	156	(100+100)/2 = 100 + 156 = 256

The second highlighted row from the Query 1 results shows that the YT query result listed the python tutorial from FreeCodeCamp.org as the first result however in the new ranking, it's in position 19 of 25 with the new scoring approach. The calculation for the FreeCodeOrg is below:

Title_R3 Score	Descrip_R3 Score	Very_Pos Count	New Score
100	57	46	(100+57)/2 = 78.5 + 46 = 124.5

Python Query 1 New Score and New Results Ranking

Query Num	Query	Search R	Channel	Video ID	Video_Title	Video Description	Descrip	Descrip_R3	Title_R3	Very_Pos	New Score	New_Order
P1	python tutorial	19	Corey Schafer	W8KRzm-HUc	Python Tutorial for Beginners 4: Lists, Tuples, a	In this Python Beginner Tut	60	100	100	256	356	1
P1	python tutorial	10	Corey Schafer	ZDa-Z5JzLYM	Python OOP Tutorial 1: Classes and Instances	In this Python Object-Orien	60	100	100	92	192	2
P1	python tutorial	15	Corey Schafer	9Os0o3wzS_	Python Tutorial for Beginners 8: Functions	In this Python Beginner Tut	60	100	100	77	177	3
P1	python tutorial	6	Derek Banas	H1elmMBnykA	Python Tutorial 2019	Get my Ultimate Python Tu	87	100	100	72	172	4
P1	python tutorial	3	CS Dojo	Z1Yd7upQsXY	Python Tutorial for Absolute Beginners #1 - Wh	Learn Python programming	93	100	100	64	164	5
P1	python tutorial	7	edureka!	vaysJAMDaZw	Python Tutorial For Beginners	Python Full Cou	Edureka Python Training (F	87	100	100	55	155	6
P1	python tutorial	2	Programming with N	_uQrJ0TkZlc	Python Tutorial for Beginners [Full Course] 201	Python tutorial for beginne	93	100	100	52	152	7
P1	python tutorial	21	Academind	kDdTgxv2Vv0	Python Tutorial for Beginners - Crash Course 20	Learn Python from scratch	93	100	100	52	152	8
P1	python tutorial	5	CS Dojo	kLZuut1fYzQ	What Can You Do with Python? - The 3 Main Ap	What is Python used for? V	93	100	57	73	151.5	9
P1	python tutorial	9	TechLead	5mJ_Qftw2_0	How to Learn Python Tutorial - Easy & sim	Ex-Google Tech Lead teach	73	100	100	49	149	10
P1	python tutorial	4	Programming with N	f79MRyMsjrQ	Python Tutorial for Programmers - Python Cras	Finally a Python tutorial for	93	100	100	46	146	11
P1	python tutorial	24	Durga Software Solu	v_S64kldryc	Learn Python - Full Fundamental Course for Beg	This course will provides yc	53	57	100	65	143.5	12
P1	python tutorial	12	Socratica	apACNr7DC_s	Python Classes and Objects || Python Tutorial	Classes are a fundamental	47	57	100	63	141.5	13
P1	python tutorial	11	freeCodeCamp.org	8DvywoWv6fI	Python for Everybody - Full Course with Dr. Chu	This Python 3 tutorial cours	87	100	57	60	138.5	14
P1	python tutorial	16	Intellipaat	5GYeia8IRbg	Python Tutorial	Python Tutorial for Beginners	Intellipaat Python course: I	93	100	100	37	137	15
P1	python tutorial	8	Derek Banas	N4mEzFDjqtA	Python Programming	Get my Ultimate Python Tu	87	100	61	49	129.5	16
P1	python tutorial	13	freeCodeCamp.org	C6jJg9Zan7w	Python Game Tutorial: Pong	A Pong clone game tutorial	60	100	100	29	129	17
P1	python tutorial	23	kjdElectronics	cpPG0bKHYKc	Python Beginner Tutorial 1 (For Absolute Begin	This Python Programming 1	60	100	100	27	127	18
P1	python tutorial	1	freeCodeCamp.org	rfscVS0vtbw	Learn Python - Full Course for Beginners [Tutori	This course will give you a f	67	57	100	46	124.5	19
P1	python tutorial	18	Intellipaat	pJ3IPRqiD2M	Python Tutorial for Beginners	Intellipaat	Intellipaat Python for Data	93	100	100	21	121	20
P1	python tutorial	14	ProgrammingKnowle	bZ6NL59FMoc	Full Python Programming Course	Python Tuto	Python is one of top 5 prog	47	57	100	37	115.5	21
P1	python tutorial	25	kjdElectronics	uPwztoPBVWI	Python Beginner Tutorial 3 - Function Return Va	This tutorial covers declarir	67	70	100	26	111	22
P1	python tutorial	17	CS Dojo	NSbOtYzIQI0	How To Use Functions In Python (Python Tutor	This entire series in a playli	40	15	100	48	105.5	23
P1	python tutorial	22	freeCodeCamp.org	CD4qAhfFuLo	Snake Game Python Tutorial	Learn to code a snake gam	47	57	100	12	90.5	24
P1	python tutorial	20	Multimedia Channel	3cZsjOclmoM	Zero to Hero with Python Programming - 2017	Are you brand new to codir	40	16	100	30	88	25

As shown in the table above, the new scores created a new ranking. The second far right column (New_Score – in Orange) show the new scores in descending order and the New_Order (far right column in yellow) shows the new order from 1-25 for the Python Query 1.

The main goal of this study was to find more relevant content, especially from less viewed videos. The YT search ranking (far left column in yellow) shows the several video that were not originally in the YT top 10 are now in the new order top 10. A user still needs to review these videos to see what video channels consistently provide the best content. Seeing the new scores and the channels which tend be the most popular (Corey Schafer, Joe James, Socratica, etc) provides the viewer with additional content to view and a way to rank these videos.

Appendix B contains the new sort order for all 8 python queries based on the new scoring approach.

Conclusion

The video results YT provides based on "relevance" does provide a user a good list of video search results but often the most viewed videos populate the top of the list while excellent but less watched videos may struggle to be seen. The study showed that YT has lots of metrics (views, like count, dislike count, total comments) but additional steps need to be taken to create new rank approaches.

Comments provide a rich source of feedback on a video and using Naïve Bayes, this study quantified the number of positive comments. This was combined with fuzzy matching on the video titles and descriptions to create a new video ranking indicator which did move some of the lesser watched quality videos higher in the ranking.

While this study showed you can apply machine learning to classify comments and develop new ranking, video creators still to create high quality videos that will make users want to leave positive comments and drive more views.

Appendix A – Python Query Statistics EDA

Python Query 1: "Python tutorial"

P1 python tutorial

Python Query 2: "Python reading CSV files"

P2 python reading CSV files
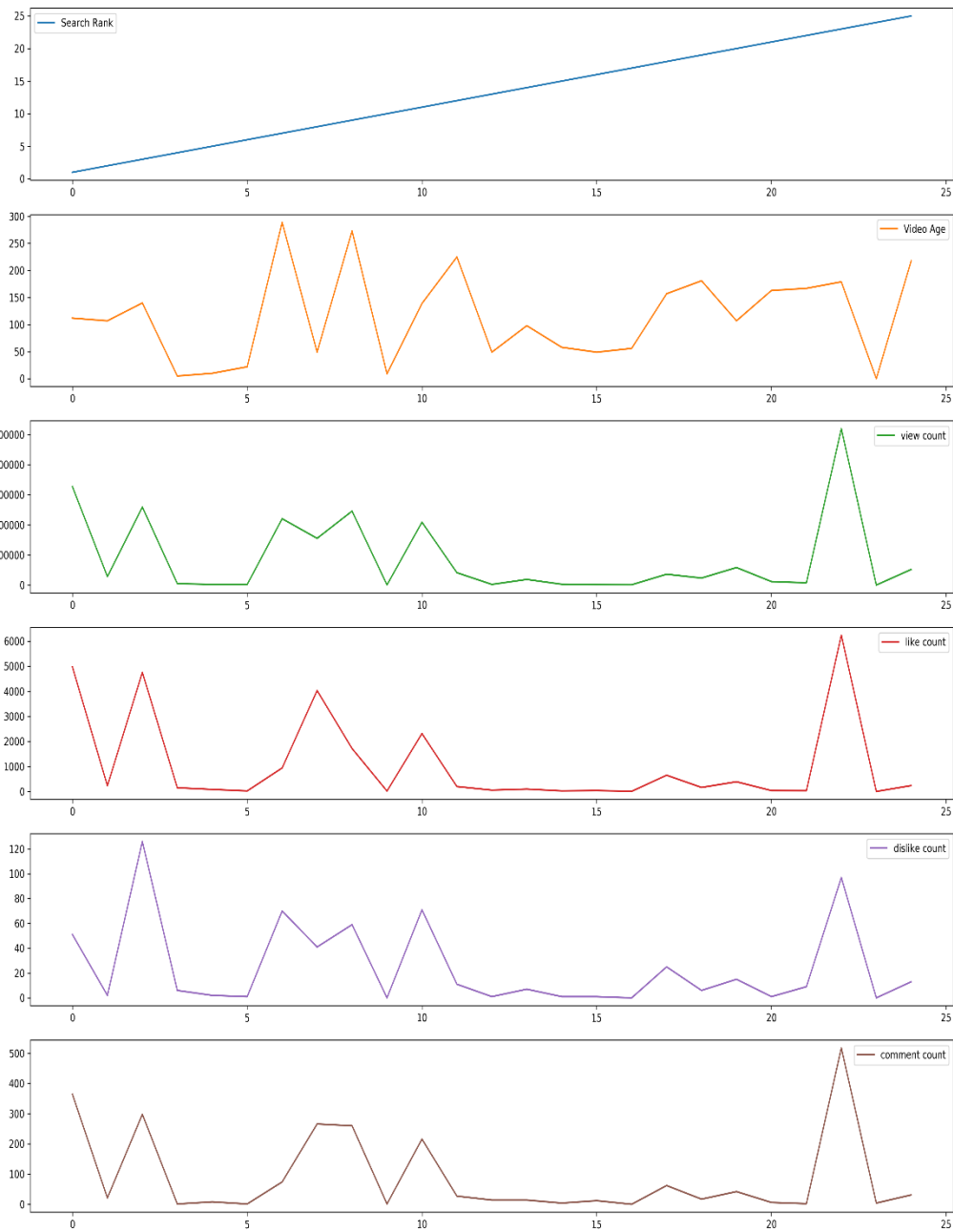
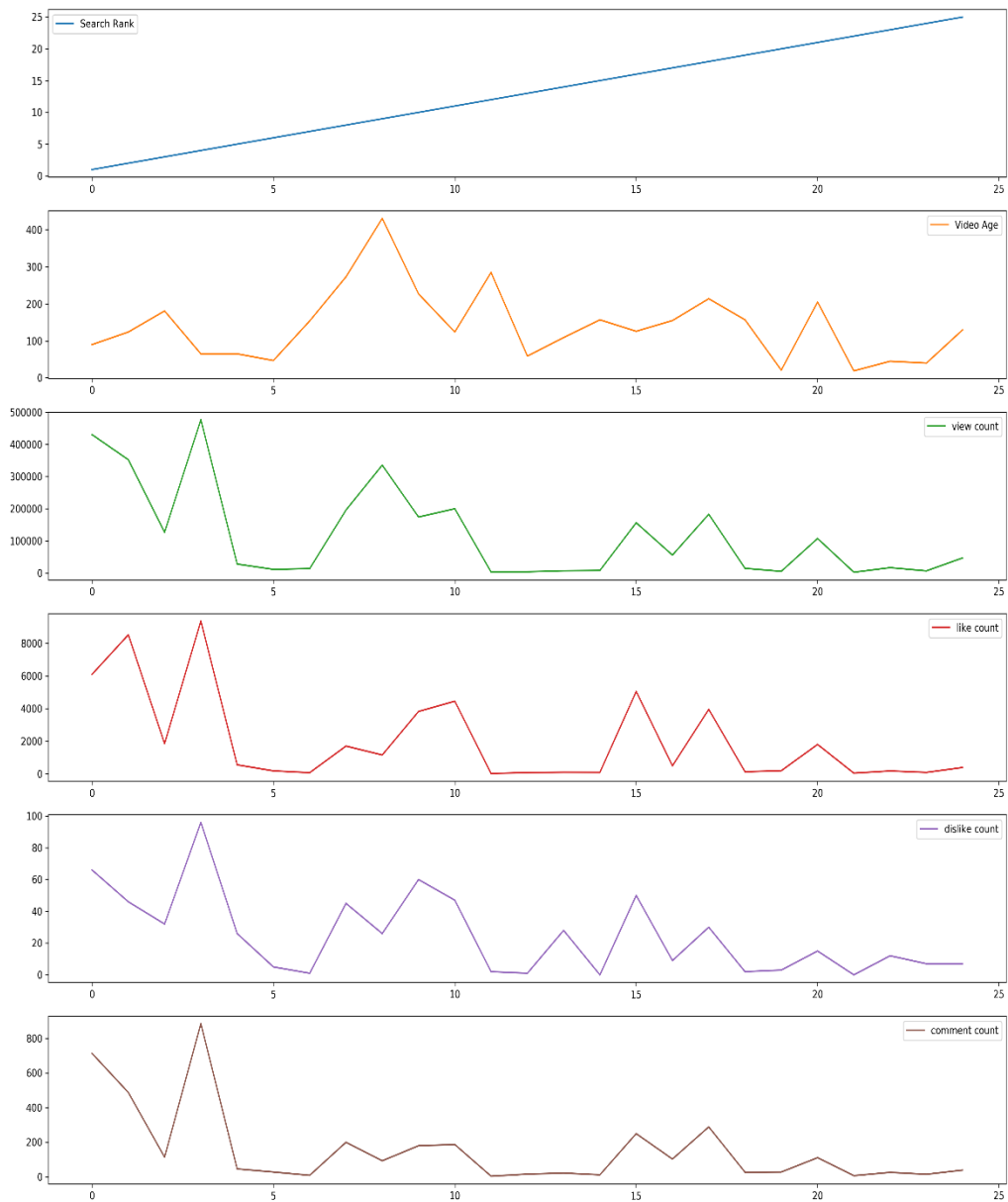# Python Query 3: "Python pandas dataframes"
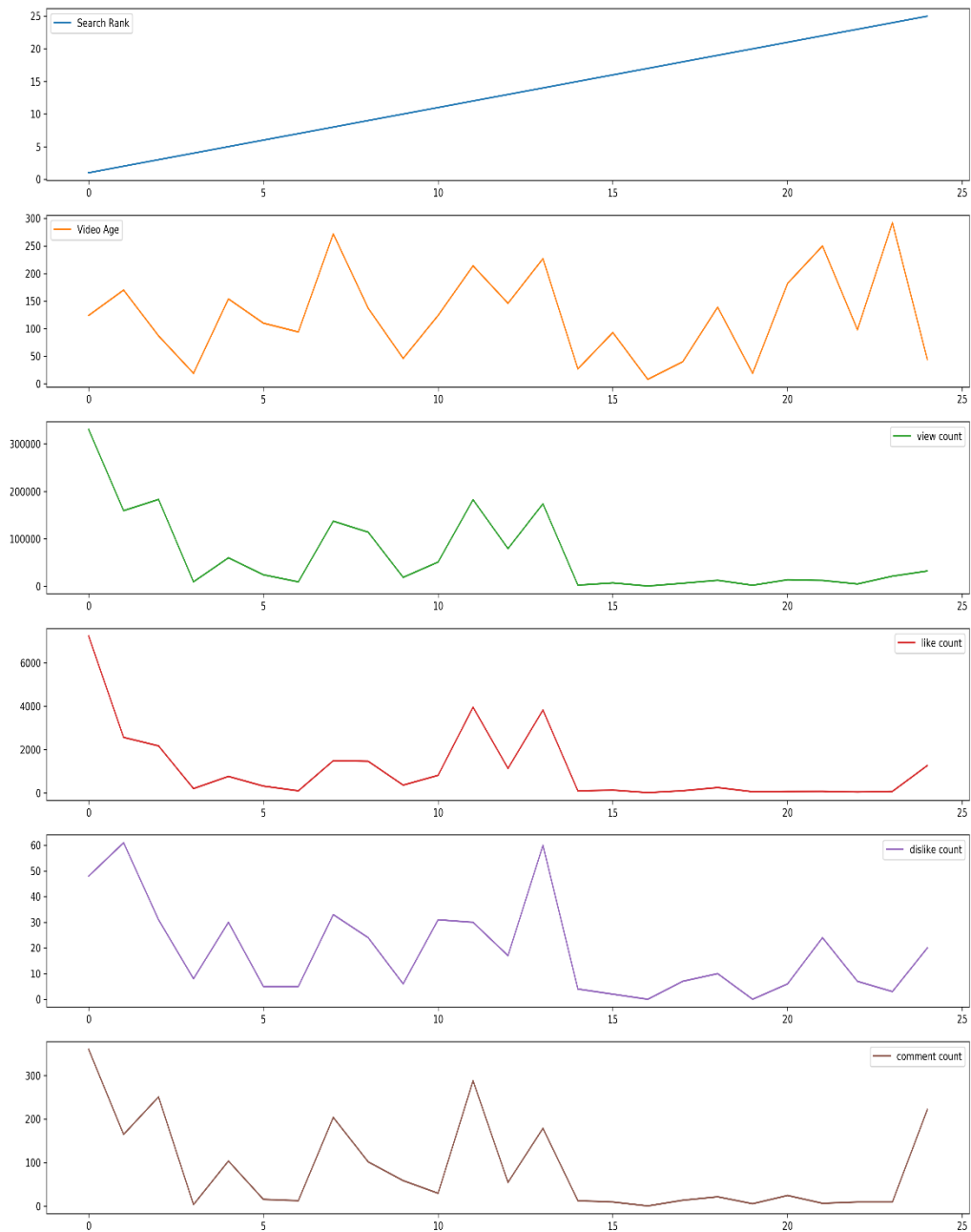
P3 python pandas dataframes

Python Query 4: "Python lists"

P4 python lists

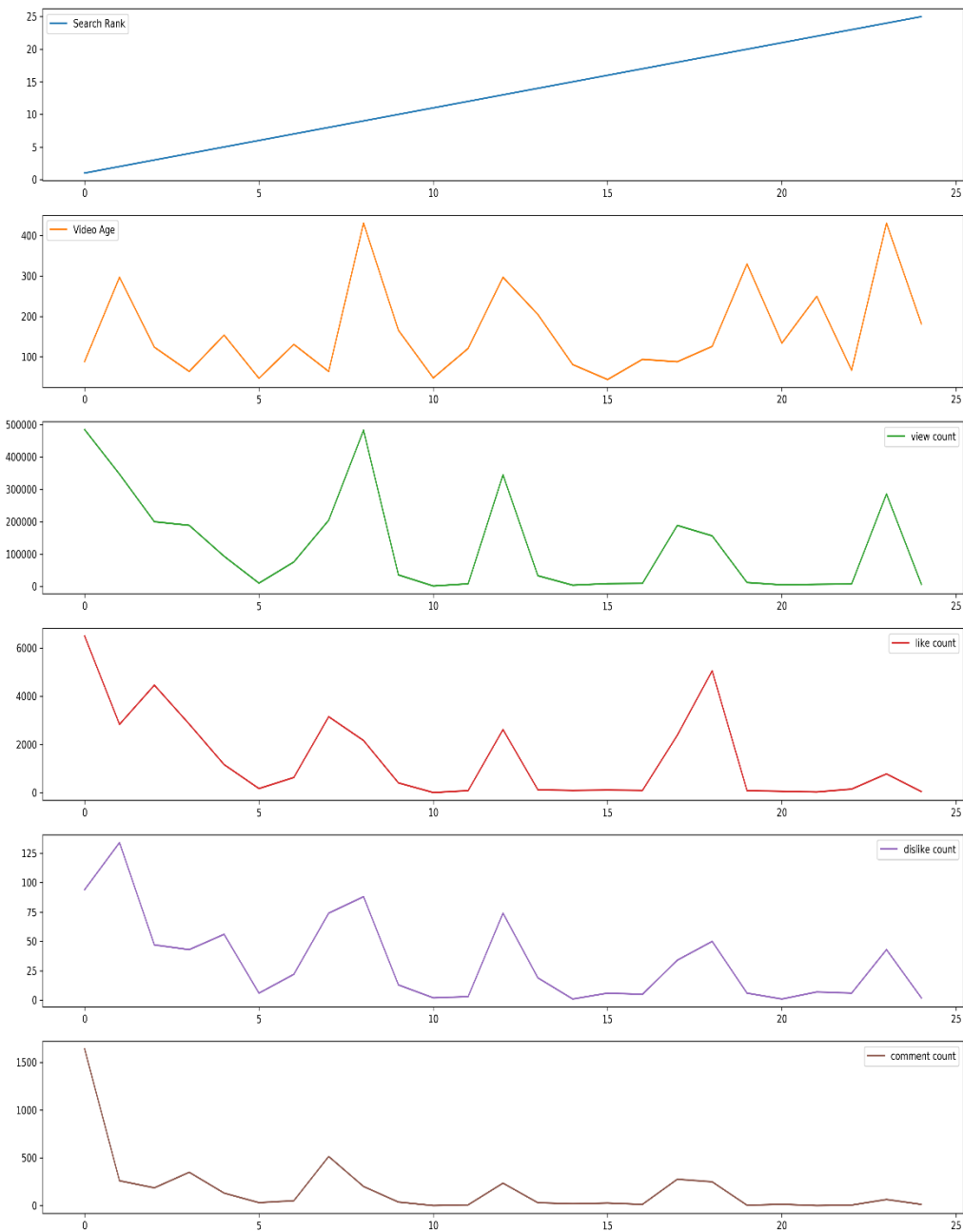# Python Query 5: "Python dictionaries"

P5 python dictionaries

Python Query 6: "Python sort functions"

P6 python sort functions

Python Query 7: "Python for loops"

P7 python for Loops

Python Query 8: "Python tuples"

P8 python tuples

Appendix B – Python Query New Rankings

Python Query 1: "Python tutorial"

Query Num	Query	Search R	Channel	Video ID	Video_Title	Video Description	Descrip	Descrip_R3	Title_R3	Very_Pos	New Score	New_Order
P1	python tutorial	19	Corey Schafer	W8KRzm-HUcc	Python Tutorial for Beginners 4: Lists, Tuples, an	In this Python Beginner Tut	60	100	100	256	356	1
P1	python tutorial	10	Corey Schafer	ZDa-Z5JzLYM	Python OOP Tutorial 1: Classes and Instances	In this Python Object-Orien	60	100	100	92	192	2
P1	python tutorial	15	Corey Schafer	9Os0o3wzS_I	Python Tutorial for Beginners 8: Functions	In this Python Beginner Tut	60	100	100	77	177	3
P1	python tutorial	6	Derek Banas	H1elmMBnykA	Python Tutorial 2019	Get my Ultimate Python Tu	87	100	100	72	172	4
P1	python tutorial	3	CS Dojo	Z1Yd7upQsXY	Python Tutorial for Absolute Beginners #1 - Wh	Learn Python programming	93	100	100	64	164	5
P1	python tutorial	7	edureka!	vaysJAMDaZw	Python Tutorial For Beginners	Python Full Cou	Edureka Python Training (F	87	100	100	55	155	6
P1	python tutorial	2	Programming with M	uQrJ0TkZlc	Python Tutorial for Beginners [Full Course] 201	Python tutorial for beginne	93	100	100	52	152	7
P1	python tutorial	21	Academind	kDdTgxv2Vv0	Python Tutorial for Beginners - Crash Course 20	Learn Python from scratch	93	100	100	52	152	8
P1	python tutorial	5	CS Dojo	kLZuut1fYzQ	What Can You Do with Python? - The 3 Main A	What is Python used for? V	93	100	57	73	151.5	9
P1	python tutorial	9	TechLead	5mJ_Qftw2_0	How to Learn Python Tutorial - Easy & sim	Ex-Google Tech Lead teach	73	100	100	49	149	10
P1	python tutorial	4	Programming with M	f79MRyMsjrQ	Python Tutorial for Programmers - Python Cras	Finally a Python tutorial for	93	100	100	46	146	11
P1	python tutorial	24	Durga Software Solu	v_S64kldryc	Learn Python - Full Fundamental Course for Be	This course will provides yo	53	57	100	65	143.5	12
P1	python tutorial	12	Socratica	apACNr7DC_s	Python Classes and Objects || Python Tutorial	Classes are a fundamental	47	57	100	63	141.5	13
P1	python tutorial	11	freeCodeCamp.org	8DvywoWv6fl	Python for Everybody - Full Course with Dr. Chu	This Python 3 tutorial cours	87	100	57	60	138.5	14
P1	python tutorial	16	Intellipaat	5GYeia8IRbg	Python Tutorial	Python Tutorial for Beginners	Intellipaat Python course:	93	100	100	37	137	15
P1	python tutorial	8	Derek Banas	N4mEzFDjqtA	Python Programming	Get my Ultimate Python Tu	87	100	61	49	129.5	16
P1	python tutorial	13	freeCodeCamp.org	C6jJg9Zan7w	Python Game Tutorial: Pong	A Pong clone game tutorial	60	100	100	29	129	17
P1	python tutorial	23	kjdElectronics	cpPG0bKHYKc	Python Beginner Tutorial 1 (For Absolute Begin	This Python Programming	60	100	100	27	127	18
P1	python tutorial	1	freeCodeCamp.org	rfscVS0vtbw	Learn Python - Full Course for Beginners [Tutori	This course will give you a f	67	57	100	46	124.5	19
P1	python tutorial	18	Intellipaat	pJ3lPRqiD2M	Python Tutorial for Beginners	Intellipaat	Intellipaat Python for Data	93	100	100	21	121	20
P1	python tutorial	14	ProgrammingKnowle	bZ6NL59FMoc	Full Python Programming Course	Python Tutc	Python is one of top 5 prog	47	57	100	37	115.5	21
P1	python tutorial	25	kjdElectronics	uPwztoPBVWI	Python Beginner Tutorial 3 - Function Return Va	This tutorial covers declarin	67	70	100	26	111	22
P1	python tutorial	17	CS Dojo	NSbOtYzIQI0	How To Use Functions In Python (Python Tutori	This entire series in a playlis	40	15	100	48	105.5	23
P1	python tutorial	22	freeCodeCamp.org	CD4qAhfFuLo	Snake Game Python Tutorial	Learn to code a snake gam	47	57	100	12	90.5	24
P1	python tutorial	20	Multimedia Channel	3cZsjOclmoM	Zero to Hero with Python Programming - 2017	Are you brand new to codii	40	16	100	30	88	25

Python Query 2: "Python reading CSV files"

Query Num	Query	Search R	Channel	Video ID	Video_Title	Video Description	Descrip	Descrip_R3	Title_R3	Very_Pos	New Score	New_Order
P2	python reading CSV files	8	Keith Galli	vmEHCJofslg	Complete Python Pandas Data Science Tutorial	Data used in this Tutorial: h	33	40	100	153	223	1
P2	python reading CSV files	3	Socratica	Xi52tx6phRU	CSV Files in Python || Python Tutorial || Lear	Working with CSV files is sir	62	80	80	68	148	2
P2	python reading CSV files	23	Corey Schafer	Uh2ebFW8OYI	Python Tutorial: File Objects - Reading and Writ	In this Python Tutorial, we	54	67	91	69	148	3
P2	python reading CSV files	1	Corey Schafer	q5uM4VKywb/	Python Tutorial: CSV Module - How to Read, Pa	In this Python Programmin	54	80	80	55	135	4
P2	python reading CSV files	11	codebasics	-0NwrcZOKhQ	Python Pandas Tutorial 4: Read Write Excel CSV	This tutorial covers how to	62	83	59	58	129	5
P2	python reading CSV files	9	sentdex	K_oXb04izZM	Python 3 Programming Tutorial - Reading from	In this Python 3 programm	50	59	86	44	116.5	6
P2	python reading CSV files	12	Tutorial Spot	BpgbECVTryk	Python Programming Reading CSV Files - Part 0	In this video we will look at	79	100	100	10	110	7
P2	python reading CSV files	2	Pretty Printed	efSjcrp87OY	Reading CSV Files In Python	Reading CSV files is a comm	67	100	100	6	106	8
P2	python reading CSV files	18	Coding is for girls	a8V6b1iy-Hg	Python Basics: Reading Data From CSV File	Let's create a script that is a	46	70	86	28	106	9
P2	python reading CSV files	7	InfoQ	mlt7MrwU4hY	Python for Beginners: Reading & Manipula	A quick tutorial designed fo	62	40	100	28	98	10
P2	python reading CSV files	20	Pretty Printed	s1XiCh-mGCA	Writing CSV Files in Python	To go along with my readin	83	100	82	6	97	11
P2	python reading CSV files	19	Joe James	3Bu1tET61As	Python: Accessing CSV Files (read and write)	Reading from and writing to	75	100	80	3	93	12
P2	python reading CSV files	5	Real Python	PZNBUkuaoKU	Reading CSV Files With Python's csv Modu	You'll learn how to read sta	67	80	100	1	91	13
P2	python reading CSV files	24	Training2SQL MSBI	Hk1BZFUHUkk	python tutorials	Read csv files data using pyth	This video talks about Read	88	100	80	1	91	14
P2	python reading CSV files	14	Python Codex	0VlOiwkXrQ8	Day 14: CSV Files with Python - Read, Write &ai	Presenting you "CSV Files w	50	80	80	6	86	15
P2	python reading CSV files	6	VFX Pipeline	FNBaQTmx3Ol	How to read and write CSV files using Python	How to read and write CSV	62	80	80	1	81	16
P2	python reading CSV files	16	PyLenin	UgWK4saZTzs	How to read CSV files with Python #2 - Using cs	Writing your own parser in	50	59	80	3	72.5	17
P2	python reading CSV files	17	Learn Learn Scratch	bJDZ1wNKGEw	Reading a CSV file into a Python List	How to load a CSV file into	58	59	86		72.5	18
P2	python reading CSV files	25	PythonHow	KoRT-v0SzMs	How to concatenate multiple CSV files in one si	This video is extracted from	42	40	80	4	64	19
P2	python reading CSV files	21	A-level Archives	AqNW9UXnP0	Python: How To Read And Write To a .csv File	Kai explains how to read an	42	55	67	2	63	20
P2	python reading CSV files	22	Hello Python	OBPjFnyxoCc	HiPy	Reading data from .csv files and scatterp	This three part video will sh	42	40	83	0	61.5	21
P2	python reading CSV files	4	edureka!	k5zkC7H9AV8	How to read CSV file in Python	Python CSV M	Python Certification Trainir	54	59	59	1	60	22
P2	python reading CSV files	10	Automation with Scr	nKyWUinNO6l	Working with csv files using python3	How to r	Complete Python scripting	46	40	80	0	60	23
P2	python reading CSV files	13	PyLenin	GBD4na8AQjY	How to read CSV files with Python #1 - Without	CSVs are plain text files tha	42	34	80	3	60	24
P2	python reading CSV files	15	Raiyad Raad	7TOfPrOt2HE	Searching Data in CSV File using Python	No Description	30	42	67	3	57.5	25

Python Query 3: "Python pandas dataframes"

Query Num	Query	search R	Channel	Video ID	Video_Title	Video Description	Descrip	Descrip_R3	Title_R3	Very_Pos	New Score	New_Order
P3	python pandas dataframe	4	Keith Galli	vmEHCJofslg	Complete Python Pandas Data Science Tutorial	Data used in this Tutorial: h	54	70	70	153	223	1
P3	python pandas dataframe	1	Joe James	e60ltwlZTKM	Python: Pandas Tutorial	Intro to DataFrames	Tutorial on the basics of Py	71	70	100	56	141	2
P3	python pandas dataframe	16	Data School	xvpNA7bC8cs	How do I select multiple rows and columns fror	Have you ever been confus	46	40	43	88	129.5	3
P3	python pandas dataframe	15	sentdex	XMjSGGeJ9y8	Joining and Merging Dataframes - p.6 Data Ana	Welcome to Part 6 of the D	62	100	100	28	128	4
P3	python pandas dataframe	10	Data School	2AFGPdNn4FN	How do I filter rows of a pandas DataFrame by	Let's say that you only wan	50	40	44	82	124	5
P3	python pandas dataframe	2	codebasics	F6kmIpWWEd	Python Pandas Tutorial 2: Dataframe Basics	This pandas tutorial covers	50	40	71	64	119.5	6
P3	python pandas dataframe	9	codebasics	h4hOPGo4UVI	Python Pandas Tutorial 9. Merge Dataframes	Pandas merge function pro	54	40	100	36	106	7
P3	python pandas dataframe	21	codebasics	WGOEFok1szA	Python Pandas Tutorial 8. Concat Dataframes	This tutorial goes over how	71	83	100	13	104.5	8
P3	python pandas dataframe	3	codebasics	3k0HbcUGErE	Python Pandas Tutorial 3: Different Ways Of Cr	This tutorial covers 5 differ	79	70	70	20	90	9
P3	python pandas dataframe	14	Simplilearn	PfVxFV1ZPnk	Python Pandas Tutorial	Pandas For Data Anal	This Python Pandas tutoria	54	70	70	14	84	10
P3	python pandas dataframe	18	Learn Pandas	L0wMml__Gov	Pandas Apply - How to Apply Lambda Functions	Pandas Apply is a very flexi	62	83	83	1	84	11
P3	python pandas dataframe	17	Paris Nakita Kejser	WWgiRkvl1Ws	How to convert an XML file to python pandas d	Work with pandas and pyth	50	70	70	4	74	12
P3	python pandas dataframe	25	sentdex	8mnLZGNrAzN	Applying Comparison Operators to DataFrame	Welcome to part 12 of the	58	70	70	4	74	13
P3	python pandas dataframe	6	Data Science Tutoria	8uK65aNfQ3I	Python Pandas Tutorial 6	How to manipulate	Hi guys in this video I have	79	40	100	1	71	14
P3	python pandas dataframe	12	Data Science Tutoria	eCmdSVE1qoE	Python Pandas Tutorial 23	How to iterate ove	Hey guys...in this python pa	75	70	70	1	71	15
P3	python pandas dataframe	23	Data Science Tutoria	33-uebwQQ6Y	Python Pandas Tutorial 24	How to loop in all t	Hi guys...in this python pan	75	70	70	1	71	16
P3	python pandas dataframe	13	Noureddin Sadawi	eu_pS_NWGDI	19- Pandas DataFrames: Sorting	Visit my personal web-page	29	40	83	6	67.5	17
P3	python pandas dataframe	11	Noureddin Sadawi	9uPTA9racZ0	23- Pandas DataFrames: Creating a DataFram	Visit my personal web-page	29	40	83	4	65.5	18
P3	python pandas dataframe	22	Noureddin Sadawi	WuNGsB16Dz	15- Pandas DataFrames: How to Drop Row or C	Visit my personal web-page	29	40	83	3	64.5	19
P3	python pandas dataframe	19	Noureddin Sadawi	HRtNM_eYaE4	24- Pandas DataFrames: JSON File Read and W	Visit my personal web-page	29	40	83	2	63.5	20
P3	python pandas dataframe	7	MyStudy	vaj_GI1Sdn0	Data analysis with python and Pandas - DataFra	This video will explain Basic	67	40	70	8	63	21
P3	python pandas dataframe	5	Noureddin Sadawi	8QcEXz-S8_c	14: Pandas DataFrames: Creating a DataFrame	Visit my personal web-page	29	40	83	1	62.5	22
P3	python pandas dataframe	20	Noureddin Sadawi	nE21ZlXiByY	20- Pandas DataFrames Hierarchical Indexing (I	Visit my personal web-page	29	40	83	1	62.5	23
P3	python pandas dataframe	24	Noureddin Sadawi	ZftcMsvhE48	22- Pandas DataFrames: Writing/Saving as CSV	Visit my personal web-page	29	40	83	1	62.5	24
P3	python pandas dataframe	8	HowTo	6NbgRrilSpg	Pandas Tutorials # 2 : How to add and delete ro	This video will show you ho	62	40	40	1	41	25

Python Query 4: "Python lists"

Query Num	Query	search R	Channel	Video ID	Video_Title	Video Description	Descrip	Descrip_R3	Title_R3	Very_Pos	New Score	New_Order
P4	python lists	2	Corey Schafer	W8KRzm-HUc	Python Tutorial for Beginners 4: Lists, Tuples, ar	In this Python Beginner Tut	58	100	100	256	356	1
P4	python lists	10	Joe James	R-HLU9Fl5ug	Python: Data Structures - Lists, Tuples, Sets &ar	Tutorial on data structures	83	100	100	228	328	2
P4	python lists	18	Corey Schafer	3dt4OGnU5sM	Python Tutorial: Comprehensions - How they w	Python comprehensions ar	63	100	67	154	237.5	3
P4	python lists	16	Socratica	AhSvKGTh28Q	List Comprehension || Python Tutorial || Lea	A list comprehension is a w	67	67	67	156	223	4
P4	python lists	11	Corey Schafer	6iF8Xb7Z3wQ	Python Tutorial for Beginners 7: Loops and Iter	In this Python Beginner Tut	58	67	67	118	185	5
P4	python lists	1	CS Dojo	tw7ror9x32s	Introduction To Lists In Python (Python Tutoria	How to use Python lists. Th	92	100	100	66	166	6
P4	python lists	3	Socratica	ohCDWZgNIU	Python Lists || Python Tutorial || Learn Pyth	Lists are a way to store ord	58	100	100	52	152	7
P4	python lists	21	Corey Schafer	ajrtAuDg3yw	Python Tutorial: Slicing Lists and Strings	In this video we will look at	50	100	100	52	152	8
P4	python lists	25	edureka!	fAw8pM_dQP4	Python Lists	Python Tuples	Python Sets &an	Python Training : https://w	75	100	100	32	132	9
P4	python lists	9	Khan Academy	zEyEC34MY1A	Python Lists	Understanding the basics o	58	100	100	26	126	10
P4	python lists	8	sentdex	LUoKlnK5wcc	Python 3 Programming Tutorial - List Manipula	In this Python 3 programm	67	100	67	35	118.5	11
P4	python lists	4	Telusko	Eaz5e6M8tL4	#5 Python Tutorial for Beginners	List in Pytho	Python 3 documentation :	50	67	67	50	117	12
P4	python lists	22	Jeff Heaton	kcGx2l5akSs	Python Lists, Dictionaries, Sets & JSON (1.1	Python is a critical skill for	67	100	100	10	110	13
P4	python lists	6	Programming with M	9OeznAkyQz4	How to Use Lists in Python	How to use lists in Python.	58	100	100	8	108	14
P4	python lists	23	Simplilearn	IFzHFUvGL7I	Python Lists Tutorial	Python List Functions	P	This Python lists tutorial wil	92	100	100	6	106	15
P4	python lists	14	Mr. Rigden	2vmvtxHVPJI	Python Lists vs Arrays	Jason's rants about python	92	100	100	4	104	16
P4	python lists	7	Chuck Severance	ljExWqnWQvo	PY4E - Python Lists (Chapter 8 Part 1)	http://www.py4e.com - Py	50	67	100	6	89.5	17
P4	python lists	13	Sundeep Saradhi Kar	NMf0UXMapo	INTRODUCTION TO LISTS AND CREATING LISTS	The most basic data structu	75	67	100	4	87.5	18
P4	python lists	15	Max Goodridge	HO55hyX8EGN	Lists and Using List Index in Python (Python for	Enjoyed my video? Leave a	42	67	100	2	85.5	19
P4	python lists	24	Kindson The Tech Pr	n0krwG38SHI	Difference Between List, Tuple, Set and Diction	This Tutorials explains the c	50	67	67	15	82	20
P4	python lists	17	Clever Programmer	98LV9Pkl8z4	Learn Python Programming - 12 - Lists of Things	http://cleverprogrammer.i	58	14	100	24	81	21
P4	python lists	5	Art of Engineer	9rLdQP3g4fw	Python Lists	a complete tutorial	If this video is helpful to yo	33	12	100	22	78	22
P4	python lists	19	Amuls Academy	VNvcBfQpRgY	List Operations in Python Programming Tutoria	In this Python Programming	50	67	67	4	71	23
P4	python lists	12	Apple Juice Teaching	hLdhuLKc0MI	Intro To Python: Lists Advanced	Here is my Github link for c	50	11	100	3	58.5	24
P4	python lists	20	Academind	E1ZAVEmRwyl	Python - List Comprehensions Tutorial	List Comprehensions are a	50	11	67	7	46	25

Python Query 5: "Python dictionaries"

Query Num	Query	earch R	Channel	Video ID	Video_Title	Video Description	Descrip	Descrip_R3	Title_R3	Very_Pos	New Score	New_Order
P5	python dictionaries	14	Joe James	R-HLU9Fl5ug	Python: Data Structures - Lists, Tuples, Sets &ar	Tutorial on data structures	74	100	100	228	328	1
P5	python dictionaries	12	Corey Schafer	3dt4OGnU5sN	Python Tutorial: Comprehensions - How they w	Python comprehensions ar	46	48	48	154	202	2
P5	python dictionaries	1	Corey Schafer	daefaLgNkw0	Python Tutorial for Beginners 5: Dictionaries - V	In this Python Beginner Tut	74	100	100	76	176	3
P5	python dictionaries	2	Socratica	XCcpzWs-Cl4	Python Dictionaries || Python Tutorial || Lea	Python dictionaries allow y	95	100	100	59	159	4
P5	python dictionaries	8	sentdex	YNRc6cOwUA8	Python 3 Programming Tutorial - Dictionaries	In this Python 3 programmi	95	100	100	33	133	5
P5	python dictionaries	3	CS Dojo	ZEZdys-fHDw	How To Use Dictionaries In Python (Python Tut	This entire series in a playlis	53	21	100	54	114.5	6
P5	python dictionaries	7	London App Develor	IpbYrguvai0	08 Beginner's Guide to Python - Dictionari	Welcome to the Beginner's	79	100	100	12	112	7
P5	python dictionaries	20	Jeff Heaton	kcGx2I5akSs	Python Lists, Dictionaries, Sets & JSON (1.:	Python is a critical skill for I	68	100	100	10	110	8
P5	python dictionaries	11	PyCon 2017	npw4s1QTmP₂	Raymond Hettinger Modern Python Dictionari	"Speaker: Raymond Hettin₂	89	100	100	9	109	9
P5	python dictionaries	25	CodeWithHarry	5y1sh0-oKTE	Dictionary & Its Functions Explained | Pytl	Source Code/Additional Ma	58	48	48	60	108	10
P5	python dictionaries	9	MIT OpenCourseWa	WPSeyjX1-4s	6. Recursion and Dictionaries	MIT 6.0001 Introduction to	37	48	77	41	103.5	11
P5	python dictionaries	23	TheEngineeringWorl	yku78hREj68	Prepare For Coding Interview - Hash Tables and	Hash Tables and Dictionari₄	68	100	100	2	102	12
P5	python dictionaries	13	SF Python	p33CVV29OG8	Modern Dictionaries by Raymond Hettinger	Abstract Python's dictionar	89	100	77	8	96.5	13
P5	python dictionaries	5	Clever Programmer	l46sJnu51GY	Learn Python Programming - 16 - Dictionaries	http://cleverprogrammer.i	37	10	100	32	87	14
P5	python dictionaries	17	Art of Engineer	gbMFcxx6jKk	Python Tutorial #15; Dictionary in Python	Dictionaries in Python, repi	63	100	67	1	84.5	15
P5	python dictionaries	15	Clever Programmer	Pcle149jr60	15 - how to use dictionaries in Python (Python t	How to Automate Stuff wit	53	48	100	2	76	16
P5	python dictionaries	16	Python Programmer	P16-o-bRsTU	Python Training Nested Dictionary in Python	How to create a nested dic	58	48	69	6	64.5	17
P5	python dictionaries	10	Academind	oQfNYqz8pLs	Python - Accessing Nested Dictionary Keys	Working with .json data is a	42	17	62	24	63.5	18
P5	python dictionaries	18	Kindson The Tech Pro	n0krwG38SHI	Difference Between List, Tuple, Set and Diction₄	This Tutorials explains the c	63	48	49	15	63.5	19
P5	python dictionaries	19	Real Python	7TL1x3PO8iQ	A Crazy Python Dictionary Expression ?!	https://dbader.org/python	53	48	65	7	63.5	20
P5	python dictionaries	22	Wiredwiki English	LsF57W5Eyzk	Python Programming Tutorial- 15 Using Diction	Subscribe for weekly tutori	32	17	100	1	59.5	21
P5	python dictionaries	24	The Bad Tutorials	EqX1VWOJCTc	Python Programming Tutorial - 32: Dictionary F	In this tutorial we'll check o	53	48	51	3	52.5	22
P5	python dictionaries	21	Master Code Online	a-PA4sFETA8	How To Find Keys and Values in a Python 3 Dict	Check out our Python 3.7 t	47	48	54	1	52	23
P5	python dictionaries	4	edureka!	rZjhld0VkuY	Dictionary In Python | Python Dictionary Tutori	Python Certification Trainir	68	48	48	1	49	24
P5	python dictionaries	6	Brian Faure	TW_e9FFEDeY	Python Data Structures #1: Dictionary Object	In this video, we will begin I	63	19	59	6	45	25

Python Query 6: "Python sort functions"

Query Num	Query	earch R	Channel	Video ID	Video_Title	Video Description	Descrip	Descrip_R3	Title_R3	Very_Pos	New Score	New_Order
P6	python sort functions	1	Socratica	QtwhlHP_tqc	Sorting in Python || Learn Python Programmi	Sorting is a fundamental ta	48	69	44	60	116.5	1
P6	python sort functions	5	Telusko	Vca808JTbl8	#70 Python Tutorial for Beginners | Bubble Sor	Sorting the list using Bubble	52	69	69	27	96	2
P6	python sort functions	20	Software and Testing	B7k_npH7_qM	Python tutorial 13 - List Functions	I name and clarify many fur	57	100	86	2	95	3
P6	python sort functions	3	Corey Schafer	D3JvDWO-BY4	Python Tutorial: Sorting Lists, Tuples, and Objec	In this video we will be lear	43	69	46	36	93.5	4
P6	python sort functions	8	Alexander Ramsdell	SQkU0vAfNQo	Python Sort Functions	In this video, I explore ways	43	69	100	3	87.5	5
P6	python sort functions	2	Amuls Academy	9XkUshhnH7E	Python Tutorials - List Sorting | sort method	In this Python programmin₂	48	69	69	18	87	6
P6	python sort functions	21	Telusko	5KjapFQNxUo	#71 Python Tutorial for Beginners | Selection So	Python Tutorial to learn Py	48	44	69	24	80.5	7
P6	python sort functions	4	Amuls Academy	F_j90A48X6M	Python Tutorials - Sorted Function | How to So	In this Python programmin₂	71	69	69	9	78	8
P6	python sort functions	24	Data Science by Arp₂	8JKQZlPcclw	Python sort List	In this video I will explain y₀	71	69	81		75	9
P6	python sort functions	16	Pretty Printed	YNWjwXjyUts	How to Sort a List of Dictionaries in Python	In this video I will show you	71	69	69	3	72	10
P6	python sort functions	12	Python Programmer	7jVwRcdPOWE	Python Training Course - Python Sort List	Python training course - Py	76	69	69	1	70	11
P6	python sort functions	14	Ryan Noonan	fTaXFDwnlkM	Python Sorting Data	In this Python tutorial, we v	48	69	65	3	70	12
P6	python sort functions	17	Master Code Online	AQon8LgsGf0	Python 3.7: Sort() List Method In Python	In this Python 3.7 tutorial w	43	69	69		69	13
P6	python sort functions	11	CMPUT 175	ifAxcYfdf5w	03 Sorting with a key function in Python—CMP	Topics covered: - .sort() me	52	80	56		68	14
P6	python sort functions	9	Joe James	CB_NCoxzQnk	Python: QuickSort algorithm explained	Example of how to implem	43	69	46	10	67.5	15
P6	python sort functions	25	george boole	a1SIPE5TJnY	Python: Sort a Called Functions Returned iteral	Call a function within the sc	48	34	100	0	67	16
P6	python sort functions	6	Indian Pythonista	pHliYIPnxZU	Sorting by key in Python	This video demonstrates ho	43	69	58	1	64.5	17
P6	python sort functions	10	Left Peel	PrU6vgdWZd0	Python Programming Series (Sorting): Bubble so	This goes over the bubble s	38	36	69	6	58.5	18
P6	python sort functions	19	Data Science Tutoria	yHOHAU96uG	Python 3 Programming Tutorial | #3 Sorting da	In this #python 3 programm	57	69	46	1	58.5	19
P6	python sort functions	15	John Hammond	kDlJjzZ-VBA	Python 46 Sorted Function	Join the Family: https://dis	38	22	87	3	57.5	20
P6	python sort functions	7	PyMoondra	EvjBFPydY7w	Python tutorials: Sorting (reverse, key, multiple	LetslearnPython #sort pyth	62	69	44	0	56.5	21
P6	python sort functions	13	Real Python	goPKxNtuxWo	How to Use Python Lambda With the Sort Metl	You'll see how to use a lam	48	32	69	6	56.5	22
P6	python sort functions	18	Master Code Online	QiZd4ouPjWw	Sort List Method In Python	Python 3.7 Version - https:/	48	44	69		56.5	23
P6	python sort functions	23	atoz knowledge	inJDg_GCgWs	Python : List Index() , count() , sort() and revers	A list is a data structure in F	48	44	69	0	56.5	24
P6	python sort functions	22	PyBear	mUDQ9L4dF3	How to use Python to sort CSV data	The video explains in detail	43	32	69		50.5	25

Python Query 7: "Python for loops"

Query Num	Query	Search R	Channel	Video ID	Video_Title	Video Description	Descrip	Descrip_R3	Title_R3	Very_Pos	New Score	New Order
P7	python for Loops	19	Socratica	AhSvKGTh28Q	List Comprehension || Python Tutorial || Lea	A list comprehension is a w	56	77	55	156	222	1
P7	python for Loops	3	Corey Schafer	6iF8Xb7Z3wQ	Python Tutorial for Beginners 7: Loops and Iter	In this Python Beginner Tut	50	100	100	118	218	2
P7	python for Loops	1	CS Dojo	OnDr4J2UXSA	Introduction to For Loops in Python (Python Tu	For loops Python tutorial. T	56	100	100	56	156	3
P7	python for Loops	9	Khan Academy	9LgyKiq_hU0	For Loops in Python	Basics of for loops in Pytho	43	100	100	55	155	4
P7	python for Loops	5	Clever Programmer	fBlvTEOTzvs	Learn Python Programming - 20 - For Loops	Code Notes -- https://repl.i	62	72	100	40	126	5
P7	python for Loops	8	Telusko	HZARImviDxg	#20 Python Tutorial for Beginners | While Loop	Python Tutorial to learn Py	56	77	77	37	114	6
P7	python for Loops	17	London App Develop	IpbYrguvai0	08 Beginner's Guide to Python - Dictionari	Welcome to the Beginner's	62	100	100	12	112	7
P7	python for Loops	6	Programming with N	94UHCEmprCY	Python For Loops - Python Tutorial for Absolute	Python for loops. Learn Pyt	88	100	100	10	110	8
P7	python for Loops	13	sentdex	jSs58VZVLw8	Python 3 programming tutorial: While Loop	The two distinctive loops w	62	100	55	31	108.5	9
P7	python for Loops	7	edureka!	zFvoXxeoosI	Python Loops Tutorial | Python For Loop | Whi	Python Training : https://w	69	86	100	13	106	10
P7	python for Loops	15	Keith Galli	WPF5M_Ic6Fc	For Loops & While Loops in Python - Begir	Fifth video in my python tu	62	100	100	6	106	11
P7	python for Loops	16	Simplilearn	4dN4Cn4u2M(	Python Loops Tutorial | Python Loops For Begin	This Python loops tutorial v	62	100	100	6	106	12
P7	python for Loops	12	TheCodex	3CxbKUUIULs	Python Programming #9 - For Loops	Python Programming for B	62	100	100	3	103	13
P7	python for Loops	25	Everything Coding	QylORvppiAA	[Part 9] Python 3 for Beginners - Loops and Ran	Hello and welcome to my F	56	100	100	2	102	14
P7	python for Loops	18	CS Dojo	iVyWLmQ0QY	More About For Loops in Python & Solutic	This entire series in a playlis	56	20	100	39	99	15
P7	python for Loops	2	sentdex	xtXexPSfcZg	Python 3 Programming Tutorial - For loop	The next loop is the For loo	69	32	77	42	96.5	16
P7	python for Loops	4	Telusko	0ZvaDa8eT5s	#21 Python Tutorial for Beginners | For Loop in	Python Tutorial to learn Py	56	77	77	18	95	17
P7	python for Loops	21	Stefan Mischook	1SQi6gificE	Python Loops with the range() function	This video lesson is from m	62	86	86	6	92	18
P7	python for Loops	20	Rengen	xoL7aXFwDRE	Python Tutorials - For Loops and Lists	In this episode we go more	69	72	100	3	89	19
P7	python for Loops	14	Master Code Online	YT6ldZuBW4Y	Iterate Through Python List Using For Loops	Python 3.7 Version - https:,	50	55	100	6	83.5	20
P7	python for Loops	10	Left Peel	shO5VbD2rNI	Python Programming Series (Loops 4): Nested I	A look at how to nest loops	50	48	86	11	78	21
P7	python for Loops	11	Learn Learn Scratch	8MEKchJhUoY	Python For loops Tutorial 2 - Advanced For Loo	Python programming chall	81	55	100	0	77.5	22
P7	python for Loops	24	Khan Academy	D0Nb2Fs3Q8c	While Loops in Python	Seeing that a while loop cai	50	38	86	12	74	23
P7	python for Loops	22	Wiredwiki English	x0Y2jaRMwEY	Python Programming Tutorial- 13 Using Strings	Subscribe for weekly tutori	38	32	100	1	67	24
P7	python for Loops	23	LearnVern	IS7AAVl77kA	How To Use Loops Statement In Python? | Part	For more Free courses and	44	32	86	4	63	25

Python Query 8: "Python tuples"

Query Num	Query	Search R	Channel	Video ID	Video_Title	Video Description	Descrip	Descrip_R3	Title_R3	Very_Pos	New Score	New Order
P8	python tuples	2	Corey Schafer	W8KRzm-HUc	Python Tutorial for Beginners 4: Lists, Tuples, ar	In this Python Beginner Tut	54	100	100	256	356	1
P8	python tuples	6	Joe James	R-HLU9Fl5ug	Python: Data Structures - Lists, Tuples, Sets &ar	Tutorial on data structures	62	100	100	228	328	2
P8	python tuples	1	Socratica	NI26dqhs2Rk	Python Tuples || Python Tutorial || Learn Py	Python Tuples are small an	85	100	100	77	177	3
P8	python tuples	15	edureka!	fAw8pM_dQP	Python Lists | Python Tuples | Python Sets &am	Python Training : https://w	62	100	100	32	132	4
P8	python tuples	4	sentdex	RVXlBZvg-W8	Python 3 Programming Tutorial - Lists and Tupl	In this programming tutoria	69	100	100	19	119	5
P8	python tuples	16	Keith Galli	_zFl6ytHHdY	Lists & Tuples in Python - Beginner Python	In this video, we go over tw	69	100	100	19	119	6
P8	python tuples	19	ProgrammingKnowle	XQOWZidQSnl	Python Tutorial for Beginners 14 - Python Tuple	In this video I am going to s	85	100	100	8	108	7
P8	python tuples	9	Simplilearn	wRC4H-k57eg	Python Tuples | Python Tuples Tutorial | Pytho	This Python tuples tutorial	92	100	100	7	107	8
P8	python tuples	25	Amuls Academy	kxBXrdbGSvo	Python Tuples | Python Programming Video Tu	In this Python Programming	62	100	100	4	104	9
P8	python tuples	24	SimplyCoded	YTa0wbrOeEo	12 - Tuples (unpacking) | Python Tutorials	The read-only list. Learn ab	62	100	100	3	103	10
P8	python tuples	12	TheCodex	2Df-unA0xNA	Python Programming #7 - Tuples	Python Programming for B	54	100	100	2	102	11
P8	python tuples	17	GeeksforGeeks	lv_Z6loukOs	Python Programming Tutorial - Tuples | Geeksf	Find Complete Code at Gee	62	100	100	0	100	12
P8	python tuples	14	Chuck Severance	odIMpHInDbA	Python for Informatics - Chapter 10 - Tuples	This is Chapter 10 from Pyt	62	63	100	18	99.5	13
P8	python tuples	23	Corey Schafer	GfxJYp9_nJA	Python Tutorial: Namedtuple - When and why s	Named Tuples in Python ar	54	100	63	12	93.5	14
P8	python tuples	18	Clever Programmer	gGTDBKsYfRc	Learn Python Programming - 34 - Tuples	Enroll for exercises, project	46	63	100	3	84.5	15
P8	python tuples	13	edureka!	QswQA1lRIQY	Python Collections: Lists, Tuples, Sets & Di	Python Certification Trainir	54	63	100	2	83.5	16
P8	python tuples	10	MIT OpenCourseWa	ncpb4wIsQu8	Tuples	MIT 6.0001 Introduction to	54	63	100	1	82.5	17
P8	python tuples	3	Telusko	Mf7eFtbVxFM	#6 Python Tutorial for Beginners | Tuple | Set ir	Python Tutorial to learn Py	54	63	63	18	81	18
P8	python tuples	7	Kindson The Tech Pr	n0krwG38SHI	Difference Between List, Tuple, Set and Dictiona	This Tutorials explains the c	46	63	63	15	78	19
P8	python tuples	8	MIT OpenCourseWa	RvRKT-jXvko	5. Tuples, Lists, Aliasing, Mutability, and Cloning	MIT 6.0001 Introduction to	54	63	63	14	77	20
P8	python tuples	20	Durga Software Solu	r3pRMDerAJw	Fundamental Data Types || Python Data Type:	Python Tutorial | |ajava py	62	63	63	4	67	21
P8	python tuples	5	Sundeep Saradhi Kar	bdS4dHIJGBc	PYTHON TUPLES (Creating , Updating , Deleting	1) Creating a Tuple 2) Upda	54	21	100	4	64.5	22
P8	python tuples	21	LearnVern	3ApyXxihs-A	Tuples in Python - Part 1 | Video In Hindi	For more Free courses and	31	11	100	4	59.5	23
P8	python tuples	22	Sundeep Saradhi Kar	TltKabcTTQ4	BASIC OPERATIONS ON TUPLES - PYTHON PRO	1) LENGTH 2) CONCATENA	8	13	100	3	59.5	24
P8	python tuples	11	Mike Dane	DehzAA0ZlhA	Tuples | Python | Tutorial 13	Giraffe Academy is rebrand	23	9	100	2	56.5	25