Module 1 Covariances Pen/2 atlasteren welnted at vonance for Dum Data Set. In he session, we looking at vording for higher Bum. data Sets. The inhuhan and dofuntar nuchad larlier does not really want in he same way in higher dimensioni, and Squerry vectors is not really dylaned Ossume we have a 2 bain danset, we On now Coupute variano in he x director and of direction But he vonace are insufficient to describe what s going on in the data set.

In particular, we only have he vonon han of the data in eighter direction independent of he other direction, but mon we also be entersted inthe relationship between the x ady waralls. and this consulted he concept of the Cormance Setween her Components come into play. Lets have a lock at an Example in 2 Dum's: Fen his data set we con Compute the variance in of drechon, advanance in a direction, which indicated by vertical and horzantal (Bar: le pc) But how can be un splicent, be cause we con lak at other Eg's whome he variances in'
X, y drecha are same, but data set hash very duplear

Theye of data set, but vonances in x, y diechon are exactly he seme, and mean values are also identical. and I can look at different sets leke this one here, ad he are (tree 4 data let looks vey dy land) You've kan 4 dyland Eg's, but 4 deparent pagerte or shopes of data set, but vorrance in andy, and wear values are identical. If we exclusively florers on the herizantal and verteal spread of data, we cont explain oney Correlation Setween, xand y.

In the last sligure we can cleanly see that an awayed If the X value of data point increas, then an average the y-value decreas (see pi) to hat r, and y are negatively correlated. the notion of the vonance to what is called no co-vortance of deta. The Co-vorance between xady is deflued as distracted value of it menis ((mean) in x diechan times y mens (mean) in y direction" ux she expected value in y diedan"

aforementioned learner arising from or incidental to the use of the putting role aforementioned learner arising from or incidental to the use of the putting of the shuttle service is voluntary and I accept stall to be liable for any loss, Shuttle on Kent (Pty) Ltd or any of its representatives shall to be liable for any loss, damage, injury or illness of whatsoever nature and howsoever cauled, scheed by me or the minor learner as a result, directly or indirectly, of using the shuttle service due to any reason whatsoever. The shuttle service due to any reason whatsoever. Signed at the shuttle service due to any reason whatsoever. The shuttle service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of the service due to any of its representations of	Cov[x,y] = E[(x-ux)(y-uy)]
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PARENTI GUARDIAN (NAME) PRENTI GUARDIAN (NAME)	We also have be Co-vorance term:
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·······································	· · · Cov [x,y]
Car [ty, x]	Car Ety, x]

we con summarze the volue in his matrix, Called he Co-voiance matrix, with 4 entres; in top left Comer we have venance in a drection; hen Co-vonance tem between kady in top noput comer; O verance between yard x in bottom left Commer; and von ance of y in bottom right comers Vor [c] : Cov [x,y] Cov [y,x] Vor [y] Il Corrane between x, q is possible, thereas and second average the y Walne in Crease if we in Crease it and of Convenience Setwen It is regative, then the y-value decreas, if we increas can wonder Co-vonane Setween Lady es Do, her essioned 1, y have nothing to do with each offer, her essioned.

The Co-varance Metrixis always symmetrical, positive defenutive matrix, with variance on the diagenal, deagen al, If we now, look at D Dunerson al datast, we have data set Consesting of in vectors $D = \{\chi_1, \dots, \chi_N\}$, and every χ_i is in RDHer we can compite the vorace of their dataset as 1 over N times Sum, 1=1 to Copital N, Ho menus u (mu), times x,0 minus u transpore where is the mean of data set VAR $[D] = \frac{1}{N} \sum_{i=1}^{N} (x_i - u)(x_i - u)^T$ $\int_{XD} mahx$