Vector Feilds (gen AE notes)
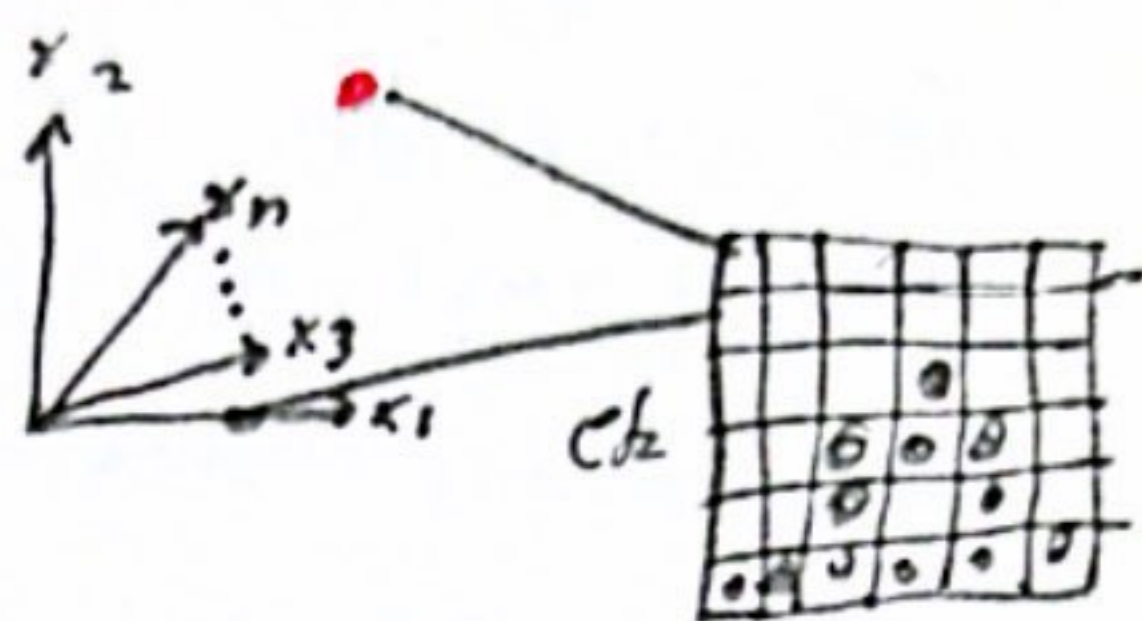
- The reason why DDPM works so well is to think of Diffusion Models as learning a time-varying vector Feild this prespective also leads to a more general approach called Flow-based models which are more popular.

- One way to think of a img is as a point in high dim space where the intensity val of each pixel is a point in this space and its intensity tells us the position

- if we reduce our img to two pixels we can visalize the distribution of our img by plotting the pixel intensity in x,y for pixels 1,2 so a img with black first pixel and white second pixel is at x=0, y=1 and so on

→ black = 0
White = 1
for intensity
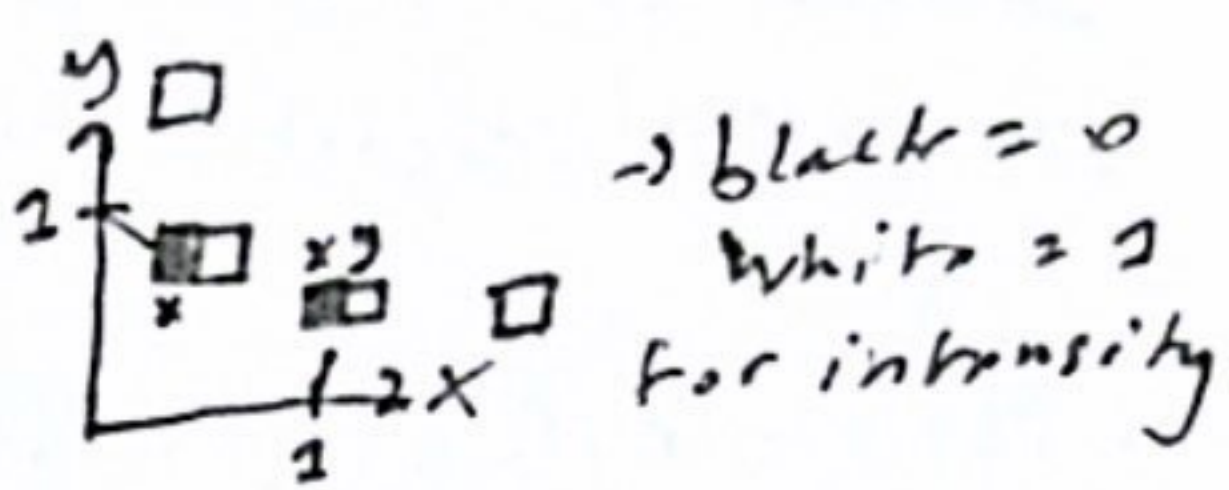
- Real images have a very specific structure in this high dim space so we can create a structure for our point in our lower 2 Dim space for our model to learn, lets start with a spiral shape

- The concept of adding noise to a img and then training a nn to reverse this process is interesting to visalize in 2D example. when we add random noise we change each pixels value by a random amount as we are in a x,y plot where the axis represent pixel intensity this means taking a step in a randomly chosen direction (Fig2). as we add more and more noise our point goes on a random walk (Fig3) our model sees this random walk for thousends of points (Fig4) and we are asking our model to reverse this process, removing noise from our img by letting this diffusion process run backwards, starting points at random locations and recovering original structure of points getting to original picture

→ random step
Fig 2

Fig 3 many steps

end of point
Fig 4
steps of many points

Noisy img
) random points to original points

original img

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(cont.)