RSG Quiz#2 Prep:

(1) Static maps: Traditional map that represent spatial info. at a particular point in time.
Ex: Printed maps.

Dynamic maps: Maps that are digital and can change in real time to reflect latest changes.

(2) Indian GIS:
① Bhuvan: dev by ISRO
② MapmyIndia
③ IRIS-AMS: • dev by NRSC (National Remote Sensing Centre)
• for agriculture monitoring

(3) Georefrencing: • Process of assigning spatial coordinates (latitude and longitude) to a raster image.
- Helps in accurate positioning and overlaying with other GIS data
- Identifying control points
↓
Applying transformation that aligns image with a coordinate system

(4) Map projection: Systematic way of representing curved earth surface on a flat map.

Since earth ⟶ Spherical
↓
representing on flat surface introduces distortions

Various map projections
- Mercator
- Lambert Conformal Conic
- Albers Equal Area

Objectives of GIS

1. Maximize efficiency of planning and decision making
2. Complex analysis
3. Capacity to integrate info from many sources
4. Removing redundant database

Five generic ques:
1. Location 2. condition 3. Trends 4. Patterns 5. Modelling

Map projection problems
1. Distortion
2. Too many ways of projection
3. There is no best way

Degree of ellipsiality (flattening): $f = \frac{b-a}{a}$

Latitude: ① Also known as parallels
② Horizontal ③ Equator at 0° latitude

Longitude: (Meridians)
① Vertically ② Prime meridian at 0° longitude
③ PM passes through Greenwhich.

Graticule: • Network of lines representing latitude and longitude.
• It helps in locating points.

India uses
(UTM): Universal Transverse Mercator
① Global coordinate system
② Divides earth into zones each 6° of longitude wide

(UPS): Universal Polar Stereographic
① specifically for polar regions.

(SPC): State Plane Coordinate System
(PLSS): Public Land Survey System

Classification of maps:

① Based on class:
Ⓐ Conic Projections Made by projecting Earth's surface onto a cone wrapped around globe.

(B) Cylindrical projections: similar to cone → just use cylinder.

(C) Azimuthal Projections: Project earth's surface onto a plane tangent to globe at a single point.

(2) Based on Aspect:

(A) Tangent: when surface of projection touches globe at single point

(B) Secand: Projection surface intersect the Globe

(C) Normal: Proje... Surface aligned with Earth's axis of rotation

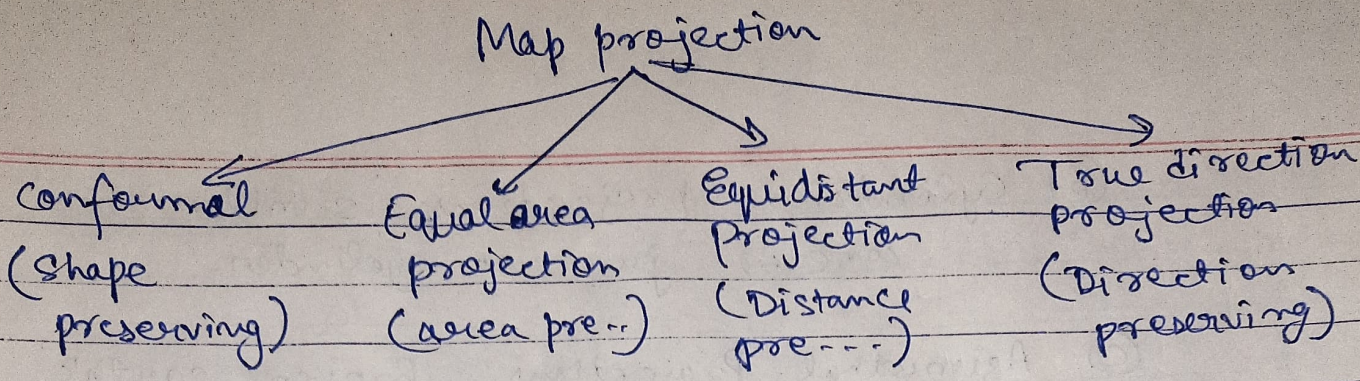
(D) Oblique: Pro... Surface oriented at an angle to the axis.

(3) Based on property

(A) Equal area Proj...: Preserve areas of Earth's surface, which make them suitable for thematic mapping

(B) Conformal: Preserves local angles, shapes and directions

(C) Equidistant: Maintain accurate distance along specific line are one or more points to all other points.



[Lambert's conformal Conic Projection]

① Class : conic
② Aspect : Tangent
③ Property : conformal

We take a cone, that is tangent to Earth's surface

Applications: Mapping large regions with east-west orientation

[Mercator Projection]

Class: Cylindrical
Aspect: Tangent
Property: Conformal

In place of cone use cylinder:
The tangent is at equator.

Preserves angles
But distorts area and distance

App: Used in navigation as it preserves direction

Map projection tips

1. Equal area map
   - → for large area on small map
2. Circular region
   - → normal planar projection
3. Elongated region
   - → conic or cylindrical
4. East - west extended
   - → conic
5. North south oriented
   - → transverse cylindrical projection

Datum: A framework to specify positions on Earth's surface.

- → consits of parameters
  - → origin (geodetic centre)
  - → orientation (rotation angle)
  - → scale factor (diff. in scale between datum and true Earth's surface)

Examples: WGS84 (World Geodetic System, 1984)
NAD83 (North American Datum, 1983)
ETRS89 (European Terrestial Refrence system 1989)

Spheroid (Ellipsoid): A mathematical model for approximating Earth's shape.

It represent Earth as ellipsoidal surface rather than perfect sphere.

Parameters
- Semi major axis
- Semi minor axis
- Eccentricity

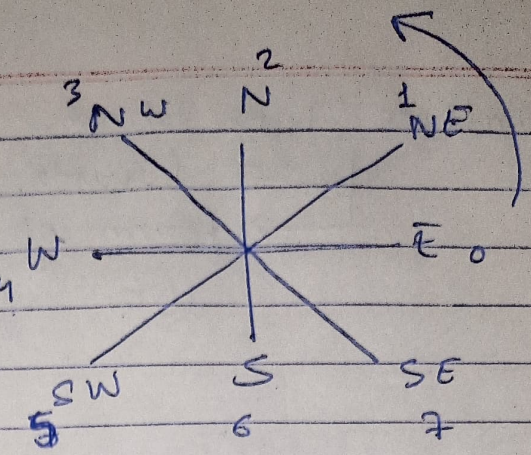
Example: WGS84, GRS80 (Geodetic Refrence System) Clarke 1866

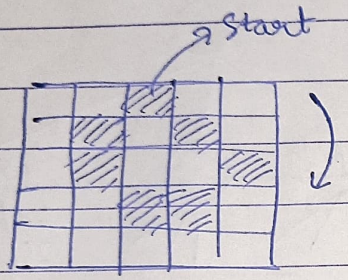
Chain codes: Method to represent boundary of a region by encoding its contours.

Algo: Start at a boundary pixel
↓
Encode the boundary by directional code
↓
Encode
↓
Continue
↓
Terminate when at start

Directional codes:

0 : East
1 : NE
2 : N
3 : NW
4 : W
5 : SW
6 : S
7 : SE





chain code: [7 7 5 0 4 3 0 2 1]

Run length Encoding:

- Count length for each run ✓

0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 1 1 1 1 1 1

↳ RLE code: (0,4), (1,5), (0,7), (1,6)

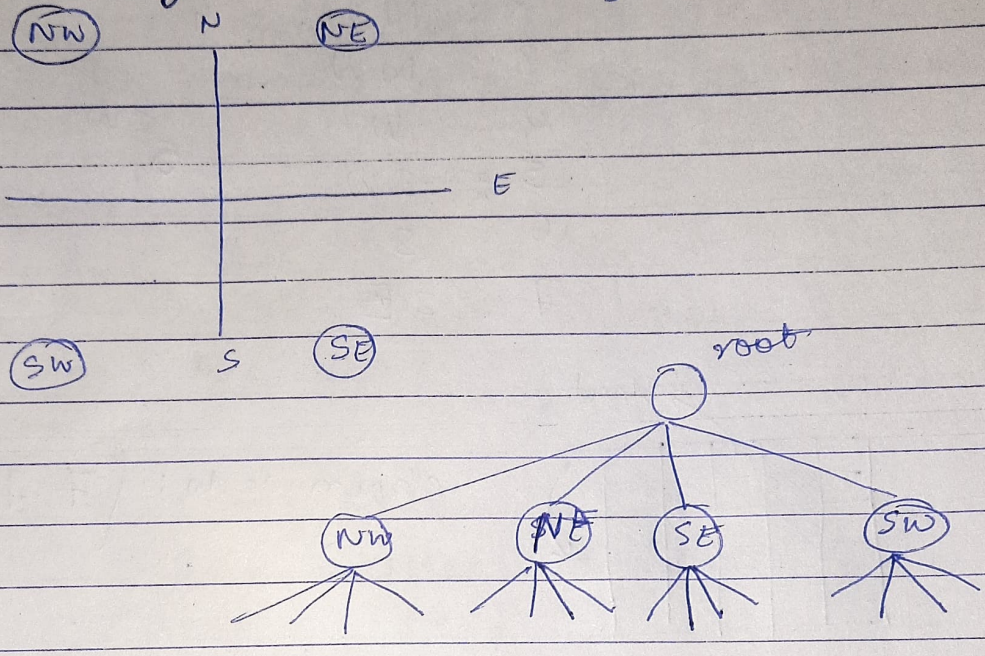
Block coding

Divide data into blocks

↳ Apply RLE on each block

Quadtree Tessellation

→ Divide space not objects
→ form of block coding



If the node consits of only one element
↳ do not further subdivide it.

Haversine formula for arc length on a sphere

$$S = 2 \times R \times \cos^{-1}\left(\sin(\phi_1)\sin(\phi_2) + \cos(\phi_1)\cos(\phi_2)\cos(\Delta\lambda)\right)$$

Radius

$\phi_1, \phi_2 \rightarrow$ latitudes

$\Delta\lambda \rightarrow$ difference b/w longitudes

Texture of image : Spatial arrangement and distribution of pixel intensities.

Methods for texture analysis

1. Gray level Co-occurang Matrix (GLCM)
2. Fractal Analysis
3. Discrete Wavelet transform
4. Laplace Filters
5. Markov Random fields
6. Granulometric Analysis

GLCM

→ Involves matrix to describe freq. of pixel intensity.

→ Haralick features are calculated using GLCM matrix.

This include Energy, Entropy, Correlation, Inverse, Inertia

Laplace filters

-1	-1	-1
-1	8	-1
-1	-1	-1

Laplace filters → derivative filters

Use to detect areas of rapic change

Better performance than Sobel filter and can outperform Haralick

Granulometric analysis

↳ Based on morphological operations involving opening and closing

Advantages → Multiscality
→ Resistance to edge effects.

Kappa Index of agreement

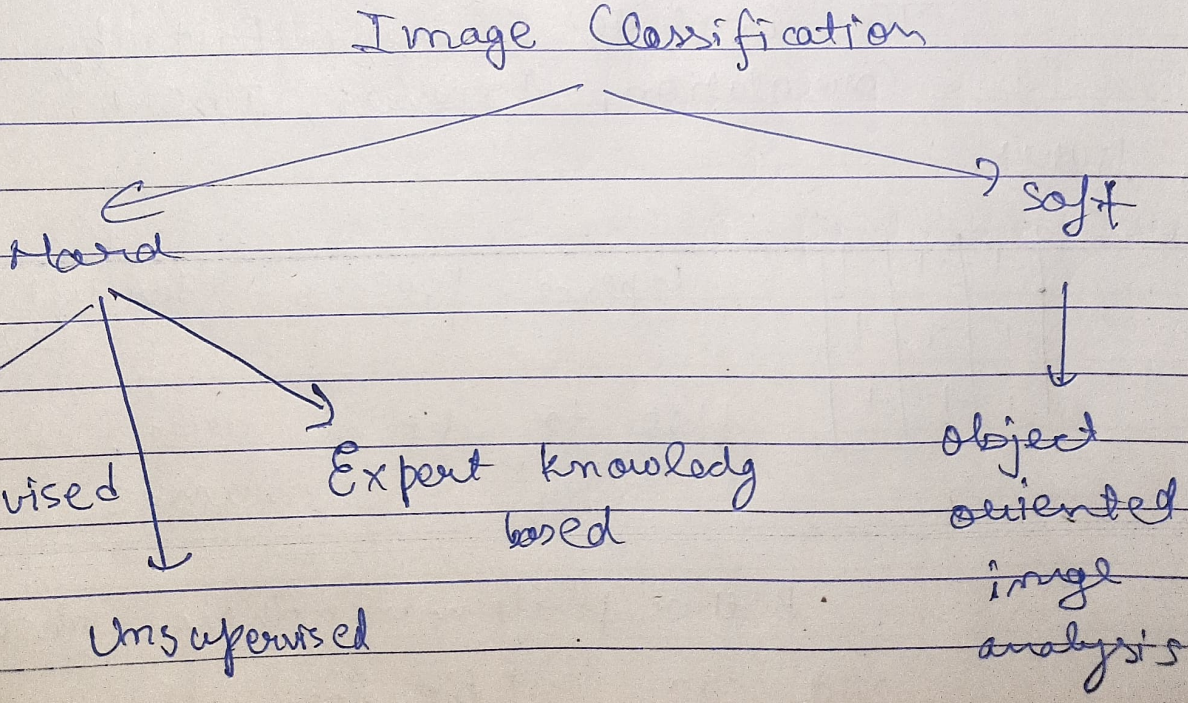
↳ $K = \frac{P_{agree} - P_{chance}}{1 - P_{chance}}$

P_{agree} = Proportion of trials in which judges agree

P_{chance} —

Image Classification

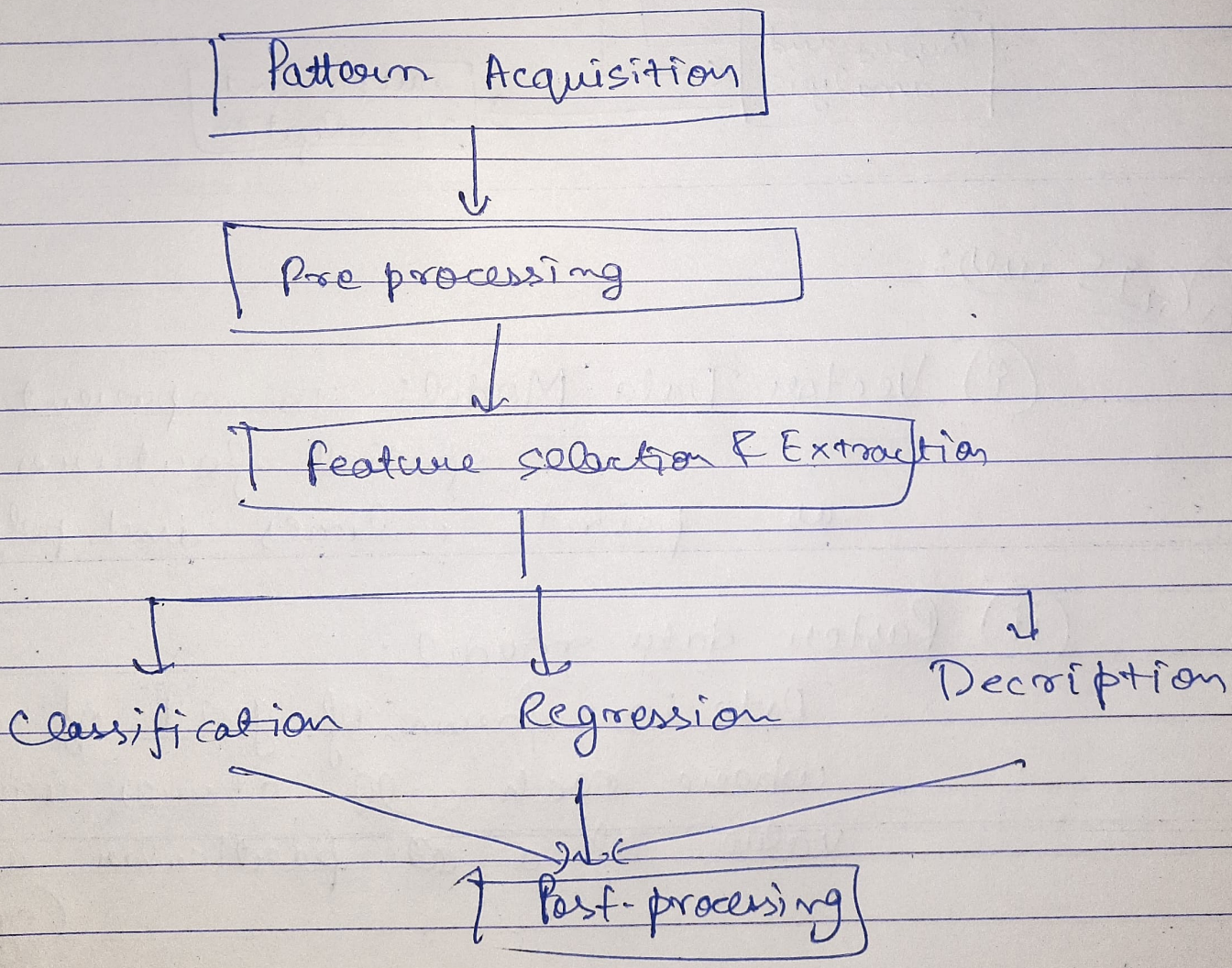
Categorizing pixel into different classes



Object-Based Classification: Using neighbour pixels we group together objects.

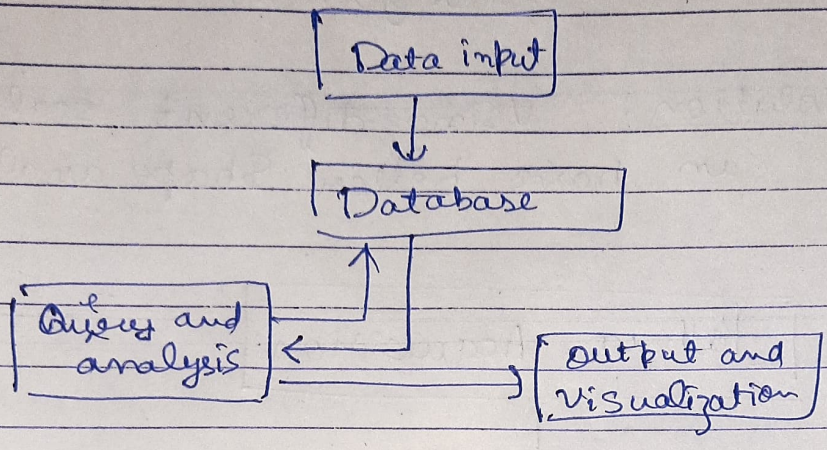
Spatial analysis: Refers to location and arrangement.

Multi-resolution: Using different scales, we can have better shape analysis



GIS functional Models:

Framework that describes various function performed by a GIS.



GIS uses:

(i) Vector Data Model: To represent spatial features as points, lines and polygons

(ii) Raster data model:
Data in form of grid of cell where each cell stores single value of a particular attribute (eg. elevation, reflectance)

(iii) Database

(iv) Support mesh data model