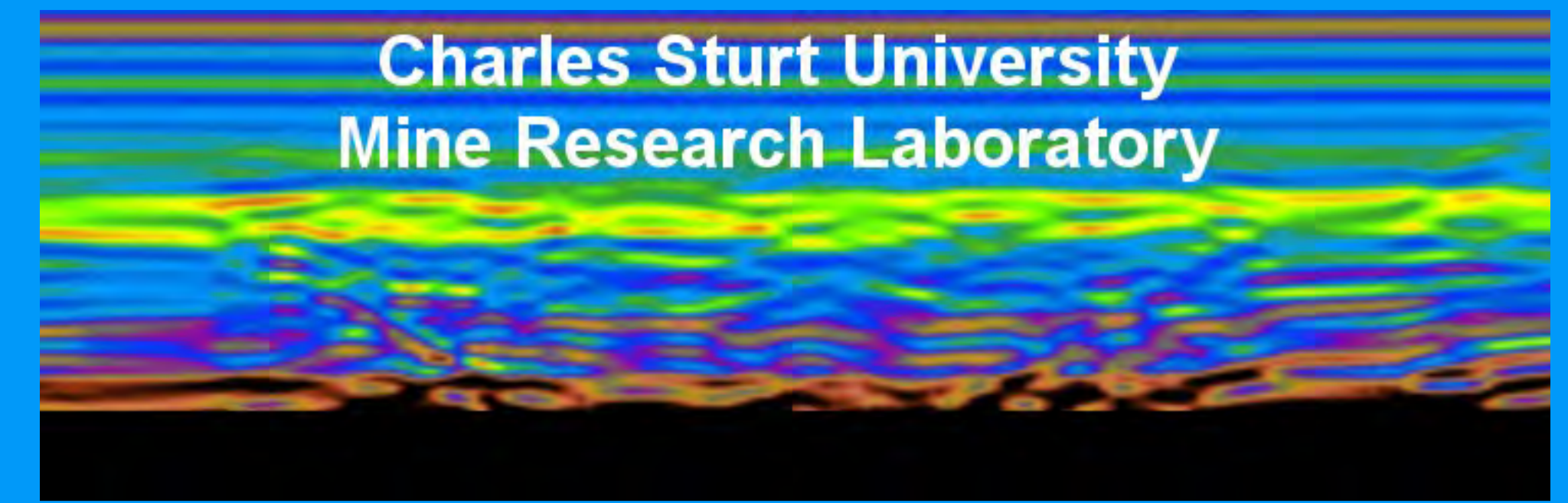


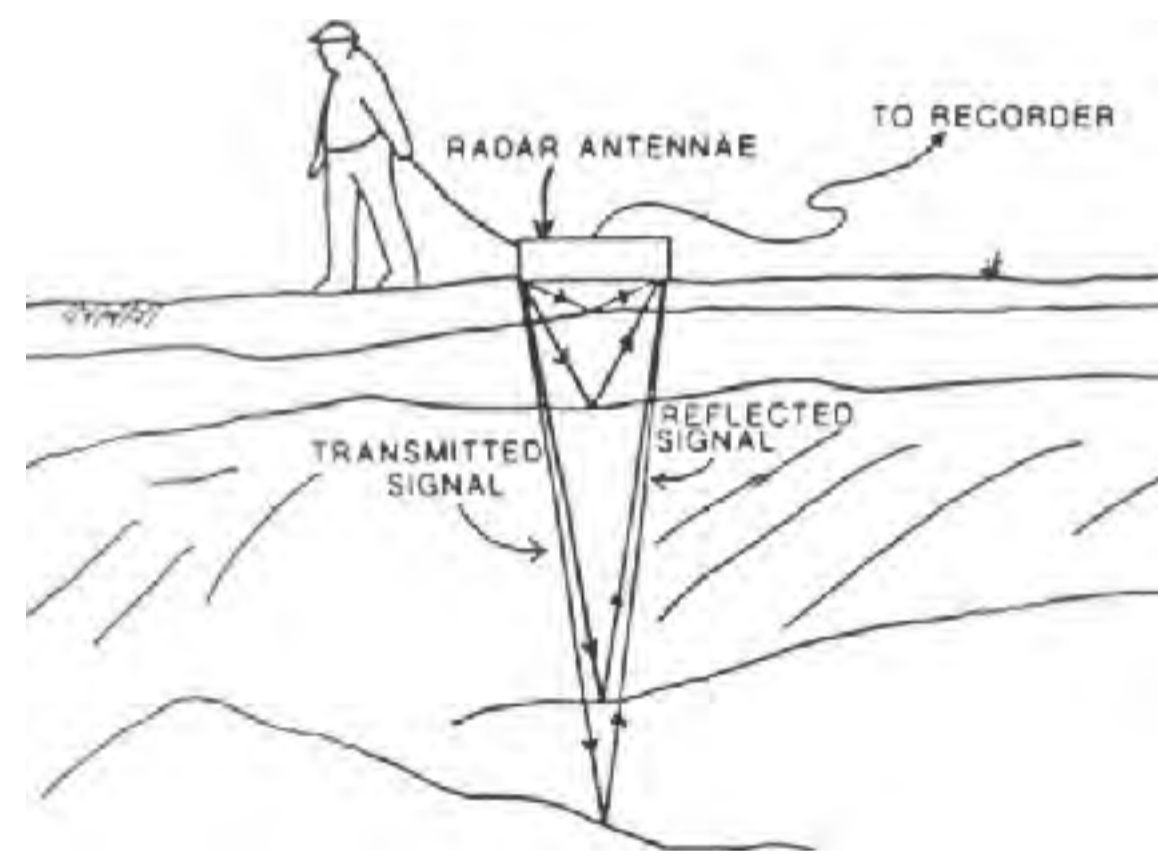
RADAR Imaging

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RADAR Basics

RADAR Imaging uses radio frequency (RF) transmissions to penetrate through materials and 'see' objects that are hidden from traditional cameras. The material through which the signal propagates causes reflections and attenuation of the signal, allowing properties of the material to be inferred.



There is a trade-off between penetration distance and resolution:



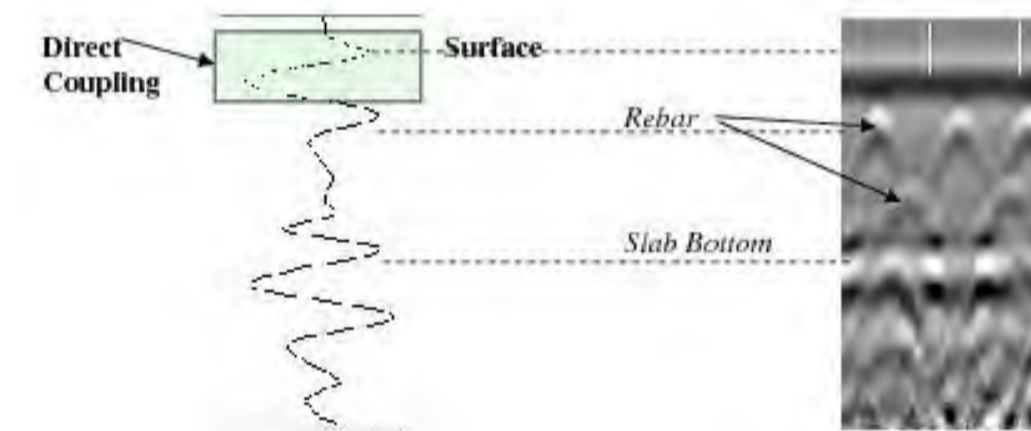
Low frequency signals can penetrate further, but the resolution of objects is reduced

High frequency signals can resolve smaller objects, but the penetration distance is reduced.

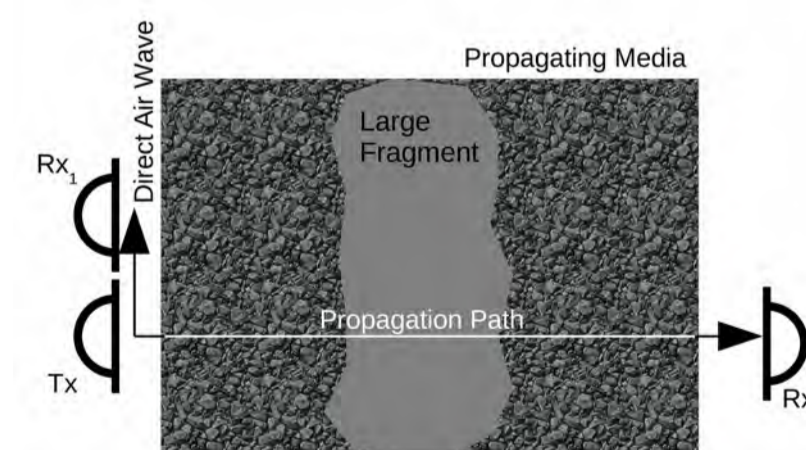
Depth is also affected by the electrical characteristics of the material, such that high conductivity reduces the depth attainable.

Imaging

In reflection mode, data captured at a single point contains the reflected RF signals over a time window. This 1D data can be stacked to form 2D or 3D images of the propagating material.



In transmission mode, the signal passes through the material to antenna(s) on the opposite side. This reduces attenuation, allowing higher frequencies or achieving greater distances.



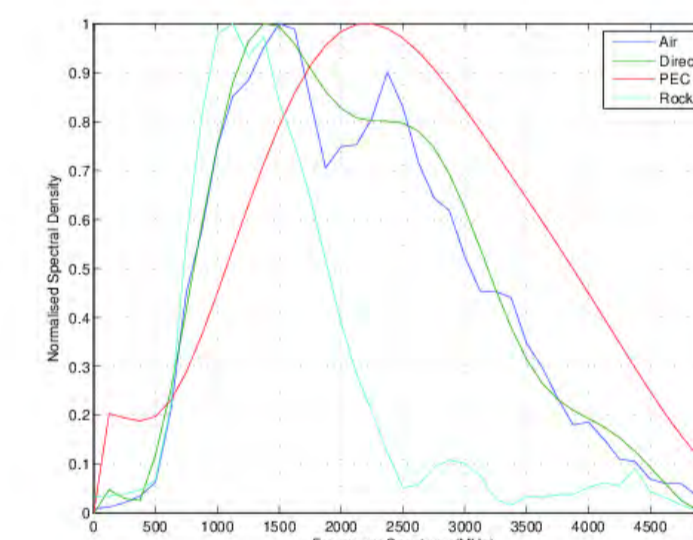
Due to the wide beam width of the RADAR signal, reflections are received over a very broad footprint, making the image appear to be unfocused.

Volume Measurement

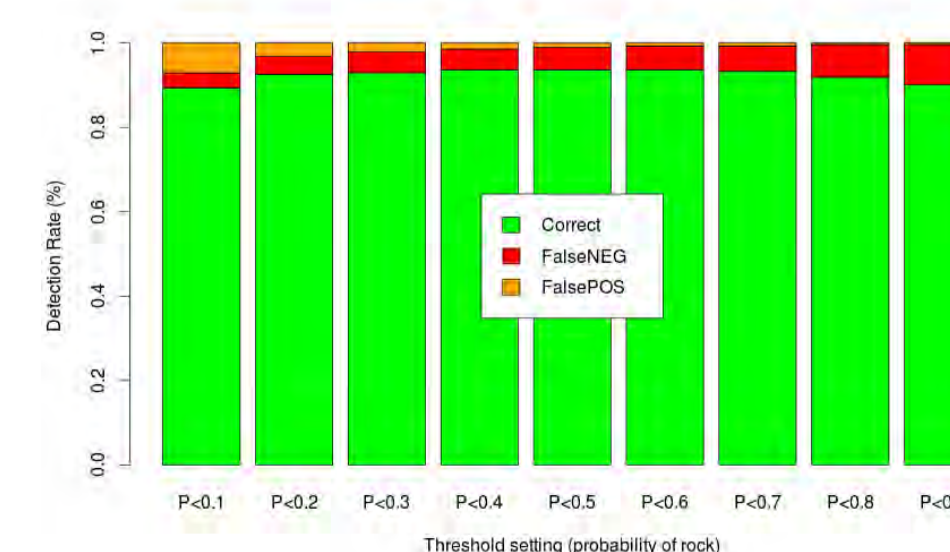
In transmission mode, we can look inside a volume space to determine the composition of objects within.



Measuring through a pile of rocks, we can determine whether a large boulder is present.

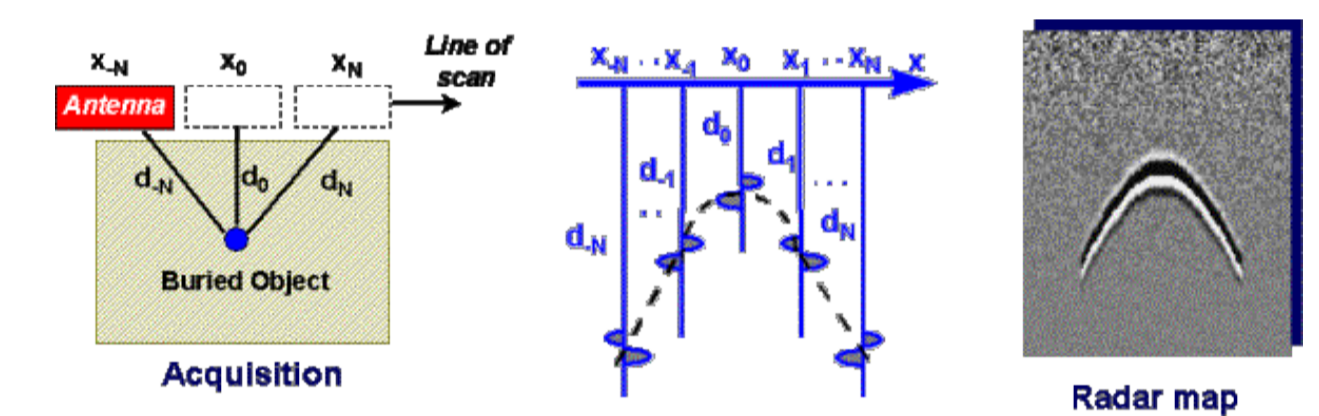


A logistic regression through 283 samples (trained over 139 samples) shows a 94% accuracy of detection.



Signal Processing

A radar scan measures the distance to objects only, hence, reflections from the same object arrive at different times in the time window when the antenna is moved.



These artefacts can be removed using migration. The motion of the antenna can also be used to automatically sharpen images.

