Conclusion & Future Directions
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Research work undertaken in this thesis deliberates on some of the crucial and live problems in remote sensing related to estimation of geospatial features like of Landuse/Landcover and Groundwater, in a time critical and data constraint environment. Both these geospatial features are preferred, since, they are crucial and decisive in leveraging decisions in every event related to the societal missions like disaster management, natural/man-made calamities, infrastructure development, agriculture and economy and away from it – in battlefield understanding. A wide range of state-of-art methodologies from soft computing constitution are attempted to explore the handling of different types of embedded uncertainties in the remote sensing data like rough sets, fuzzy sets, rough-fuzzy tie-up, granular computing based on the Modelization of human mind philosophy of soft computing and optimization techniques based on biogeography, ant colony and particle swarm from the swarm intelligence philosophy of soft computing. Also, keeping in mind of the new avenues of internet like semantic web, geo-ontology based classification of Landuse/Landcover is studied as well.

It is observed that imprecision, vagueness, independence from the a priory assumption of data distribution, the curse of dimensionality, transparency in decision making, generalization capabilities and finally the optimization are tackled superbly by the soft computing approaches when compared to the statistical probability based in vogue techniques like maximum likelihood and minimum distance classifies.

The work carried out in this thesis propose Kappa coefficient as an acceptable estimation parameter / metric for the accuracy of thematic classification of Landuse/Landcover that
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may bridge the semantics of classification in terms of User's accuracy and the producer's accuracy, as is under practice in the remote sensing community. This is approached by translating the soft computing paradigms to the image classification and then related the results with the Kappa Statistics. Therefore \( \kappa \)-coefficient may be considered as a \textit{de facto} standard for comparison of thematic classification using either techniques of classical probability based methods or the soft computing methods of machine learning.

Also, Cognitive science explanation on the knowledge is used to relate the kappa coefficient for the indirect measure of an expert's knowledge.

An integrated approach of using Case Based Reasoning and either of the optimization techniques- BBO or PSO, provides an efficient solution to the challenging problem of estimation of groundwater in inaccessible terrain. It felicitates a good optimize match to the problem case from the existing solution space in qualitative terms of Low, Medium and High.

Understanding of an Expert's reasoning mechanism in a situation of conflict in Landuse/Landcover, may it be due to the mixed pixel syndrome or due to saturation of radiometric resolution of the on-board satellite sensor, is explained in terms of the information available to the expert. That is the spectral bands data, from which the geospatial feature's signatures are generated by the expert.

The \textit{Conflict resolution}, under the rough sets framework, is extensively explored innovatively. Novel concept of \textit{Expert Knowledge Support} \( \Psi \) is introduced that may facilitates in automatic the concept,
"How to select, a prior, best expert knowledge set from the available knowledge canvas".

This gains importance when we consider the situation of human expert as intelligent resources, especial when internet has generated a notion of cyber world.

Another equally important concept introduced in this research work is:

Strength to capture the Concept by a single attribute \( \eta \).

"It decodes the intelligent thinking of an expert in a state of conflict due to mixed pixel"

A unique solution is proposed for the situation when an expert or a robot has to estimate the accuracy of classification of an altogether independent classification.

The concept of Dependency of attributes \( \gamma \), a concept from the rough set theory, is intelligently used in providing a solution to this real-life situation.

Since the training data set / labeled dataset is at the core of all concept derivations, be it the Landuse/Landcover classification, groundwater estimation or the conflict resolution problems, it will definitely be appropriate to propose that training dataset acts as a transfer of knowledge instrument.

Case study based solutions are endeavored for all the three major problems studied in this thesis especially for a time and data constrained circumstances, by tendering novel concepts, yet, there are a lot of efforts, postulates are needed since new space-borne sensors like the hyper spectral ones, are emerging on the remote sensing horizon, that may be a common source of geospatial information. Perception-based and anticipatory computing may help in understanding concepts & their complexities emerging out of expert's thinking.