Sensors Combination Assessment & Selection Methodology in Remote Sensing Satellites

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Abstract:

One of the most important factors in Remote Sensing Satellites systems is selection of the proper combination of different sensors types.
By consideration to field of sensors, technical specifications, available technologies, financial limitations and time of implementation project ؛ selection of the best sensors combination have high complications and always experts spend considerable energies and many times in understanding phase of design for this purpose.
Purpose of this implemented search is codification of manner to make suitable facility for selection of the best sensors combination for using in Remote Sensing Satellites systems. In this manner, by regard to appointed specifications of user and change them to design parameters which related to sensors (spatial resolution, spectral resolution, radiometric resolution, temporal resolution and swath width) and in the other hand, by technical specifications limitations (consumption power and weight of sensors), effort to make assessment sensors and finally suggest the best sensors combination in frame of limitations and appointed necessity.
In this essay, we propose to use "Expert Choice 2000" software which related to Analytical Hierarchy Process (AHP), for sensors combination assessment, This software has high applicatory with least number of errors.

Key words:

Sensors of remote sensing satellites, Design parameters of sensors, Expert Choice 2000 software

1. Introduction:

Remote Sensing Satellite Systems help to untie a lots' of problems in Geology, Environment, Agricultural, Atmospherical, Civil and Military fields and help to have an accurate management and incessant development.
In recent years, promote applicatory and useful levels of Remote Sensing Satellite; show effort of countries to exploitation of this technology.
Always, experts trying to select the best sensors combination for their purpose, so it is essential to define a suitable methodology for considers and assessment and select the best sensors combination from different alternatives.
Because of technical knowledge of Asian developing countries to make Remote Sensing Sensors, we considered only passive sensors.

2. Remote Sensing:

The measurement and recoding of information, data, or some property of an object or phenomenon by a device that is not in physical contact with the object or phenomenon being studied.

Sensors of Remote sensing satellites have some design parameters, such as:

2-1 Spatial Resolution:
The ability to sharply and clearly define the extent or shape of features within an image. It describes how close two features can be within an image and still be resolved as unique.
2-2 Spectral Resolution:
The number and dimension of individual wavelengths from the electromagnetic spectrum, which the sensor can detect.
2-3 Temporal Resolution:
Is a measure of how frequently the Remote Sensing Sensor will pass over the exact same location. This is also called a Revisit Time. The lower this value becomes the more often an image of the same spot can be acquired by the same device.
2-4 Radiometric Resolution:
The sensitivity the Sensor has for Recording variations in the electromagnetic spectrum. Higher values mean that more subtle appearance changes in the image can be detected.
2-5 Swath Width:
The overall plane angle or linear ground distance covered by a scanner in the across-track dimension.

Besides, Sensors of remote sensing satellites have some technical specifications limitations such as Consumption Power and Weight of Sensors. So we have **7** Criterions:

1- Spatial Resolution
2- Spectral Resolution
3- Temporal Resolution
4- Radiometric Resolution
5- Swath Width
6- Consumption Power
7- Weight of Sensors

At least, with attention to applicatory fields, which create useful algorithms, we can pinpoint position of each sensors or sensors combination between others alternatives and effort to make assessment sensors and finally suggest the best sensors combination in frame of limitations and appointed necessity, with least number of errors.

3. Assessment Methodology:

”Expert Choice2000” software was designed for analyze poly criterions decision-making problems with analytical hierarchy process technique (AHP) usage and with accomplish ability to use in personal computers.
This software has a lot’s of abilities and therewith designs decision-making hierarchy diagram and designs preferences and primacies assignment questions and final weight calculation, has decision-making sensitivity analytical ability beside changes in parameters of problems.
Ability to shows suitable diagrams and graphs for exhibits results and functions and has a user-friendly connection, is one of the most important factors of this software. This software in dependency of pro. Saaty, T.L.(AHP architect) and to be found in “www.ExpertChoice.com” address.

3-1 “Expert Choice 2000”Software operations:

At first step, after program’s goal announcement in assessment and selection the best sensors combination from different alternatives; institute to introduce criterions which they are design parameters of sensors and then assessment beside to each others individually for all fields.
At second step, institute to classification criterions in individually form according to each fields.
At least, institute to register alternatives and then according to classification of each criterion, pinpoint places of each alternative.

For example, information about some sensors accumulated in bottom table:

Satellite	Sensors	Spatial Resolution (m)					NO. Bands	Swath Width (Km)		Radiometric Resolution (Bit)	Revisit Time (Day)	Power (W)	Weight (Kg)
		Pan	MS					PAN	MS				
			VNI	SWI	MW	TIR							

LS-5	MSS	-	80	-	-	-	4	-	185	6	16	50	64
	TM	-	30	30	-	120	7	-	185	8	16	332	258
LS-7	ETM+	15	30	30	-	60	8	185	185	9(8)	16	590	441
QuickBird-2	BHRC	0.61	2.8	-	-	-	5	16.5	16.5	11	1 ~ 3.5	430	138
IKONOS-2	OSA	1	4	-	-	-	5	13	13	11	1 ~ 3	350	171
	KODAK	0.88	3.52	-	-	-	5	12.2	12.2	11	1 ~ 3	315	88
Earth Observer (EO-1)	ALI	10	30	30	-	-	10	185	185	12	16	100	106
	HSI	-	30	30	-	-	220	-	7.5	12	16	51	49
	LAC	-	250	250	-	-	256	-	185	12	16	35/45	10.5
IRS-1C	PAN	5.8	-	-	-	-	1	70	-	6	24	55/65	230
	LISSIII	-	23.5	70.5	-	-	4	-	148	7	24	74/78	171
	WIFS	-	188	-	-	-	2	-	810	7	5	22	41
IRS-P6	LISS4	5.8	5.8	-	-	-	4	70	23.9	7	5	216	169.5
	LISS3	-	23.5	23.5	-	-	4	-	141	10	24	70	106
	AWIFS	-	56	56	-	-	4	-	740	10	5	114	104
Terra	ASTER	-	15	30	-	90	14	-	60	12	5	463	421
	MISR	-	275 550 1100	-	-	-	4	-	360	12	2	83	149
	MODIS	-	250 500 1000	- 500 1000	1000	1000	36	-	2330	12	1 ~ 2	162.5	229
SPOT-5	HRG	5	10	20	-	-	5	60	60	8	1 ~ 4	344	356
	HRS	5 10	-	-	-	-	1	120	-	8	1 ~ 4	128	90
	VMI	-	1000	1000	-	-	4	-	2250	10	1	200	152

3-2Conclusion:

In total column of (EC) 2000 Program, results of classification model accumulated, grade one (100%) for the best alternative and other alternatives received their grade (%)beside to best alternative.

4. Future goals:

Provider of this essay will attempt to division applicatory fields blow-by-blow, to confer more comprehensive usage to expert choice2000 software. Also, with more consider and study of other systems and subsystems of remote sensing satellites such as communication systems or attitude determination and control subsystems (ADCS) or… effort to make assessment and select the best remote sensing satellites systems.

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